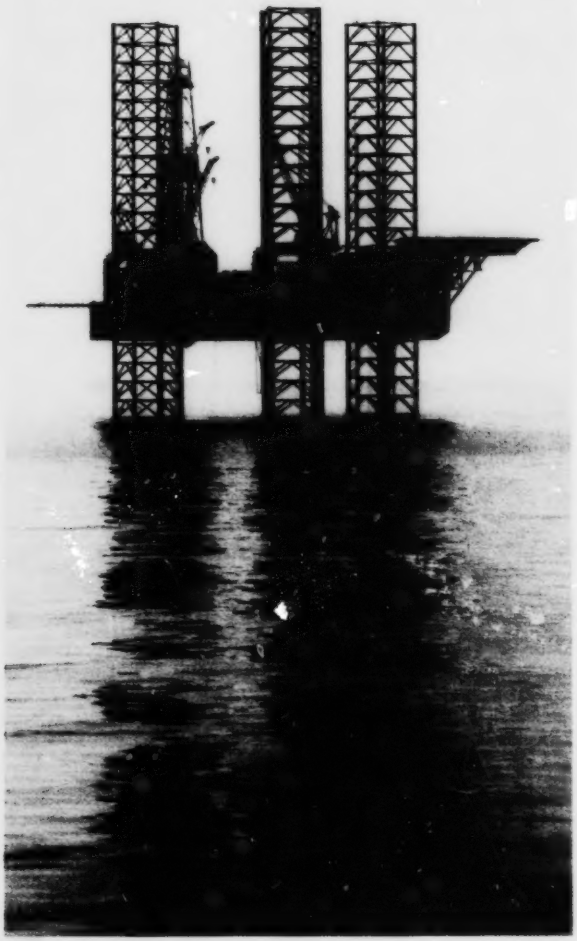
Bringing it to Market



Proceedings of the
Petroleum Industry's
Sixteenth Frontier Workshop

Fairmont, British Columbia
April 29 - May 2, 1990

Sponsored by the
Frontier Division of the
CANADIAN PETROLEUM ASSOCIATION

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Cover
The first Canadian offshore oil development to go on production will be LASMO's Cohasset/Panuke project. Light oil will begin flowing from the two fields in 1992. The production system will use a modified jack-up rig like the Rowan Gorilla III pictured.

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Canadian Petroleum Association: The Frontier Division

The growth of industry activity in the frontier areas has been accompanied by the creation of associations through which individual companies can address common concerns. For Canada's oil and gas frontiers, two associations were formed in the early 1970s: the Arctic Petroleum Operators' Association and the Eastcoast Petroleum Operators' Association. These two associations addressed technical, environmental and policy issues in the northern and east coast frontiers respectively.

In 1983, the Eastcoast Petroleum Operators' Association merged with the Canadian Petroleum Association to form an Offshore Operators' Division of the CPA. Three years later, the Arctic Petroleum Operators' Association merged into the Offshore Operators' Division, which was renamed the Frontier Division.

Through a comprehensive network of committees and input from other industry organizations, the CPA's Frontier Division addresses numerous issues of importance to the industry. These include drilling and production systems; safety; environmental planning such as developing contingency plans for oil spill containment and clean up; legislative, regulatory and other government controls; and communication with interested publics which is maintained through two semi-annual publications: The **Arctic Petroleum Review** and the **Eastern Offshore News**.

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PREFACE

The Canadian Petroleum Association's 16th Frontier Workshop took place in Fairmont, B.C. from April 29 to May 2, 1990. Key organizers for this authoritative conference were CPA personnel. Barry Virtue is Director, Divisional Services; Leo Bouchout is Director, Planning, Finance and Administration. Others on the steering committee included Stu Aitken of Mobil Oil Canada; Bob Dryden of Chevron Canada; John Loh of Gulf Canada; Steve MacInnis of Shell Canada; and Caulette Kimber, Diana Parnell and Ian Scott of the Canadian Petroleum Association. Each organizer invested long hours in making the program a success.

This book is based on a combination of written submissions by participants and transcriptions of workshop proceedings. It therefore required editorial work throughout, including decisions about which original graphics to include in the final draft. Freelance writer/editor Patricia Boyle undertook much of the editorial work under the supervision of general editor Peter McKenzie-Brown.

The editors took steps to make sure the final draft was error-free. Regrettably, however, editorial flaws may yet have crept in. Responsibility for the transcription or editorial errors finally rests with the Canadian Petroleum Association.

INTRODUCTION

The theme of the sixteenth CPA Frontier Division Workshop was the challenge of "Bringing it to Market". Over two hundred participants heard how the petroleum industry hopes to meet that challenge in the 1990s.

Panelists discussed the potential of oil and gas reserves in the frontier basins. Their estimates varied from the perennially optimistic to the very cautious. In another session, panelists tackled the task of getting oil and gas reserves out of the ground—no easy feat in the harsh conditions of the frontiers. Panelists also offered some reassurance that new technologies and refinements to existing apparatus have already lowered costs of exploration and production. The discussion then moved to the economic realities of the marketplace. Despite the need for costly technology and infrastructure in frontier ventures, there was strong agreement that the market would determine the price of oil and gas from the offshore and arctic fields. Other participants noted that industry is responding to persistently low oil and gas prices by being more selective about frontier development and by cutting costs.

Regulation is now a requisite for petroleum development in North America. In the session on regulatory regimes, provincial and federal regulators gave detailed reports on their mandates and procedures. The session led logically to what turned out to be the two emotional issues of the workshop: public consultation and environmental protection. Panelists and participants debated and explored these issues at length. Since the grounding of the Valdez in April 1989, there have been demands for greater government regulation of petroleum-related activities—and for more self-regulation by industry. There have been calls for more active public participation throughout the regulatory process. In addition, there has emerged a strong awareness of the fragility of the environment.

Participants grappled with these new realities, and shared their experiences and successes. They spoke of risk-management and the co-operative efforts taking place in the US and Canada to provide a quick, effective response to even the smallest spill. They discussed a need to regain the public trust. Above all, they explored ways to communicate their willingness to consult with the public and their commitment to be responsible partners in petroleum development.

The workshop provided a forum for the exchange of information, ideas, opinions and concerns. As participants noted, it was a unique opportunity for industry, government and the general public to share their views and perspectives on the challenge of bringing frontier oil and gas to market in the 1990s.

SESSION I

THE BROAD PERSPECTIVE

WELCOME AND INTRODUCTION

JIM KELLY,
Mobil Oil Canada Ltd
Chairman , CPA Frontier Division

I would like to welcome you to the CPA Frontier Division's 16th Fairmont Workshop. The theme of this year's workshop is "Bringing it to Market." That may sound a little optimistic, considering the present condition of the frontiers. However, we believe it is time we consider the elements that are critical to this phase of our activities.

Over the next couple of days, we will be discussing some of these critical elements and have the opportunity to hear the views of both government and industry players. We will spend the first two technical sessions talking about exploration and production fundamentals, including the potential of the frontiers and the economics of future production. Regulation and regulatory regimes are significant issues. They are created by governments and other policy-makers rather than the marketplace. They are susceptible to the influence of both the regulated industry and, increasingly, special interest groups. That is why it is so important to discuss high profile public issues which affect our industry, issues like oil spill prevention and response.

While the Valdez spill was an accident of the shipping industry, its impact on the public confidence in the total petroleum industry has been overwhelming. People do not believe in our ability to keep the environment clean, and this lack of confidence will last for some time. The repercussions from the Valdez places an obligation on us to take every step we can to prevent oil spills and to have highly trained personnel and effective technology available to clean up spills that do occur. The questions surrounding oil spill prevention and response deserve a lot of attention. All of tomorrow morning's presentations are dedicated to this issue.

Then there is the matter of public consultation. Nearly 15 years ago Canada's petroleum industry dramatically showed how important consultation can be in the decision-making process. We all remember the proposed Arctic Gas Pipe Line, which presented a case study in the value and importance of public consultation.

Since those days of relative innocence, the industry has developed some sophistication in public consultation for major projects. There is no doubt, however, that we will have to improve this process even more in the years ahead. Since we are working in areas that people perceive as ecologically

fragile, we must take every precaution in developing the frontiers to get the Canadian public to buy in to the operation. Workshops such as this one present a valuable opportunity for governments and their agencies and our agencies to work towards this end.

I am pleased to see such a good turn-out today, and I hope that you will enjoy the next two and a half days. It would be nice to say hello to everyone this year, but there is one I would like to mention who has probably come farther than anyone. His name is Earl Johnson, and he represents the fishing industry in the Come-By-Chance area of Newfoundland. I know his trip took at least 15 hours after he got to St. John's, so welcome Earl.

I have the pleasure today to be able to introduce two keynote speakers. First, we are going to hear from Doug Baldwin, who is the Chairman of the Canadian Petroleum Association. Doug frequently reminds us that we don't get paid for how long we work but for how much work we get done. He has followed his own advice. The quality of his work has taken him from a summer employee during university breaks to President of Esso Resources Canada Limited (Canada's largest liquid carbon producer).

Following graduation from the University of Saskatchewan as a chemical engineer, Doug began his 32 year career with Esso. He worked in various field positions rising to head Esso's Production Department by 1979. In 1983 he became Production Manager with Exxon in New York, where he was responsible for co-ordinating Exxon's worldwide production and development activities. In 1986 he returned to Canada and Esso Resources. He served briefly as Vice-President of Business Services before becoming President in January 1988. As Esso's President, Doug has presided over the merger with Texaco Canada Resources. This stands as Canada's largest merger to date and appears to be one of the smoothest. During much of that demanding period he also served as Vice-Chairman of the CPA. He became Chairman of our Association last month.

It gives me great pleasure to introduce Doug Baldwin as your first keynote speaker.

DOUG BALDWIN
Chairman, Canadian Petroleum Association and
President, Esso Resources Canada Ltd.

FIRST KEYNOTE SPEECH

Mr. Minister, Mr. Chairman, ladies and gentlemen. One of this country's continuing industrial strengths is its ability to face an uncertain future with confidence. I think this conference's theme typifies that confidence. The theme suggest there will be a market. It then suggests that we will produce our frontiers to serve that market.

I share that view.

Threshold reserves of gas have been discovered in the frontier areas of Canada, and we have the lead discoveries for oil development as well. The focus today is on balancing financial, socio-economic and market forces to achieve development.

I, like most of you, work for a company and in an industry that must make long-range plans. This is particularly so in Canada's frontiers. We first make forecasts—usually many of them. We then develop plans to realize those forecasts. More than 25 years after the first investment, we are still making plans.

Although forecasts are often overtaken by events, we can't plan without making them.

Despite the hazards of planning, plan we must. Expecting problems and providing for them are necessary parts of the process. Our future, or in fact much of it, really is unfolding according to plan, albeit at a somewhat slower pace than many of us would have expected.

The need to involve ourselves in the planning is obvious. There is greater assurance in entering a future we helped to anticipate, and in fact helped to create, than stepping into one in which we had no hand.

If we look around us, the clues to our future are all about us, but the most significant changes are taking place on the people side in our decision-making processes. The shifts in the way we govern ourselves may not be of the magnitude of the changes occurring in Eastern Europe—nor as clear, or dramatic—but they are nonetheless profound.

The old and accustomed "command and control" method of governance is gone. We are learning to work effectively within a new and unfamiliar consultative arena.

There are two important principles that support the shift.

First, as a society, we have decided to consult all those affected by our laws or industrial plans.

Second, society demands and industry accepts that we must meet the full social cost of our activities. This second principle acknowledges the public's right to examine critically our performance.

These two principles will strongly influence our future ways of living and doing business. Following the Berger moratorium in the North and the development in the Mackenzie Valley, we really do have a second chance to try again. Participation and consultation are prerequisites to northern development today.

Canada's parliamentary system sometimes appears slow, cumbersome and inefficient. But I believe the emerging decision-making process, which

involves a much broader constituency, will make it even more difficult—in fact, it may make Parliament seem like a picnic in comparison to dealing with all the quarters of this nation that we are going to have to involve in the consultative process.

Undisciplined, it will be even slower and more cumbersome. Our society, our economy and our industry depend on making the new process work.

The quality of our decisions can be no better than the quality of information behind it. Given accurate information, honest people make sound choices. Given honest differences, there is a need for a process to bring about a compromise acceptable to all participants.

Science and economics provide us with absolutes to bring discipline to our debates. Even scientists and economists, however, can disagree. When they do, replacing rhetoric with reason may not be easy. Reason, however, must dominate if the consultative process for making decisions is to work.

In the debate-prone question of global warming, the United Nations is attempting to provide us with a model for dispute resolution. The UN has assembled an International Panel on Climate Change, which has access to the world's science and to its scientists.

It supposedly has no political purpose; the good of the world is its only mandate. The UN panel needs to establish the global facts to which we can turn when making our decisions.

At a more local level, the CPA is making a contribution through its leadership on environmental issues in our industry. I am particularly encouraged by the fact that the government is establishing a consultative process to allow all sections of society to contribute to the environmental discussion.

It is pretty clear the consultative process is here to stay. Our future rests with learning to make it work.

In our industry, we have learned that decisions made unilaterally weigh most heavily upon those excluded from the process. Society and industry respond with bitterness and strong opposition to isolated decisions.

Our industry has also learned that government intervention in the marketplace does not work. Such intervention usually finds commodity production either failing to meet economic demand or else grossly exceeding it. Canada's National Energy Program stands as a textbook case of isolated decision-making gone wrong.

All of this points to the need for stable, predictable and encouraging government policy for this industry. Awareness of our industry's needs and role is essential to such policy.

I link the need for sound policy and the means for achieving it to the consultative decision-making process. Such policy is central to all else in my message today.

Several elements are essential to the conference's theme "Bringing it to Market." I'll speak of each one in turn. Let me emphasize that the key element is a stable, encouraging government policy. Without it, the other elements are really academic.

The second element is geology. The NEP provided conclusive evidence that when projects fail the geological test, no government policy or subsidy can make them work. I rank geology second only to government policy. That's because, without an encouraging policy framework, we're unlikely to go out and test those rocks.

Another essential element is technology. Over this element, our industry does have some control. The efficiency of production and transportation systems for our high-cost frontier resources are economic stop-and-go signs. Indeed, the technology and production costs are so closely related that I'll not deal with them as separate elements.

A trained and available work force is also a necessary element. Policy impediments must not deter sponsors from investing in costly training and recruiting. To attract people in the numbers and with the qualifications needed, we must be able to ensure employment stability within our industry.

Acceptable standards of environmental practice now rank with geology as a project requirement. Good science will expedite our activities. We, governments and industry, must work together to get the facts on the environment into the hands of decision-makers.

Market economics ranks with geology and environmental considerations as a key element to frontier development. Our collective view of the future is that there is a prospective market for our production.

In the Beaufort and off the east coast, where reserves have been proved, development depends on a somewhat higher price.

Efficient and effective project management in a period of uncertain price forecasts is the challenge of frontier development in Canada today.

The final element that I want to talk about is investment capital. Capital always flows to opportunity. In our case, capital must have considerable patience as well as opportunity.

I've outlined seven key elements. While the absence of any one can stall frontier development, the glue combining the others is an environment in which we can all work together.

I began by speaking about a different decision-making process. Essentially, it calls for involving all those with a stake in the decision.

If we think about it from a practical perspective, not everyone can participate in every decision. We must have high levels of trust to reduce the number of decisions needing broad consultation. The CPA frontier development conferences have been an important factor in establishing the contacts and trust that are valued by industry and government people who work Canada's frontiers.

I don't see participation as an end in itself. Indeed, I see participation as a means for optimizing individual and organizational effectiveness. We must make our decisions at the levels having the best understanding of the issues. So often these get elevated above that level.

Learning to work effectively with governments, the public and public interest groups is taxing industry resources. It is also demanding and costly to our governments. It is clear to me that we all have a stake in making that process work better.

There is something that we—people in this industry—can do as individuals. We are welcome to become involved in the decision-making process. I believe that welcome carries with it a responsibility.

Who knows better about frontier issues than the people in this room? Are we present when groups are forming to consider our projects?

I will come full circle to a statement I made in the beginning. People make right choices when they have the right information, and if we have that information, we obviously have a duty to share it.

I will conclude with a look at some of our frontier projects—those projects that we might term "on the road" to market.

We have a lot going for us. Canada's resource base is unsurpassed among western nations. The Canadian market alone is too small to encourage the mega-project developments that are required to utilize fully our frontier resources. Happily, we're next door to the world's largest customer for crude oil and natural gas. Our problem is one of timely development.

The conventional western Canada basin is maturing. We expect a production drop in light crude of about 280 000 barrels a day over the next five years. In other words, by 1995 we will have 280 000 barrels a day lower production level from our conventional production base. Perhaps the better news is the estimated potential of 3-4 billion barrels of undiscovered crude oil remaining in western Canada.

Obviously we need to improve our ability to find smaller pools. We must also reduce operating costs. In conventional areas, we need a combination of improved fiscal regime and, clearly, improved technology.

Increased synthetic production output will also replace part of the conventional decline. The bi-provincial upgrader will have an impact here.

The 2.5 trillion barrels of bitumen in Alberta's oil sands have tantalized us for a century. We need new, more effective recovery processes to open new areas to production and to improve their economics.

The OSLO project, as an example, is still in the engineering stage. When engineering is complete, the consortium will decide on its next step. The OSLO project is one of the key elements needed to replace declining light crude production. It could start delivering product in the latter half of the 1990s.

Hibernia could start production by late 1996, if the participants and governments reach agreement by mid-year. Reserves from Terra Nova may add to offshore production volumes before the end of this decade.

An earlier, smaller development may proceed on the Scotia Shelf near Sable Island. The Cohasset-Panuke project, officially rated at 30,000 barrels a day, is on the planning boards to start in 1992.

Beaufort gas represents a large, proved resource, which is dependent on price and market forces. Development of gas from the region is something that many of us have been awaiting for a long time and something that will bring much needed economic development to the region.

Amauligak is the lead oil project in the Beaufort Sea. But additional reserves are needed to support a transportation system for liquids out of the north.

Our industry was never easy. Each challenge met has led to larger, more difficult challenges. Today, we face environmental, economic, technological and social challenges of giant proportions.

No one of us alone is equal to the task before us. However, I am confident that, together, we can and will make it happen.

Thank you.

JIM KELLY:

It is now my pleasure to introduce our second keynote speaker, The Honourable Jake Epp.

Mr. Epp has represented the Manitoba riding of Provencor since he was first elected to the House in 1972. In 1979 he became the Minister of Indian and Northern Affairs in the short-lived Clark government. He was named Minister of Health and Welfare following the 1984 election, and in January of 1989 was appointed to his present portfolio, Minister of Energy, Mines and Resources.

This is the third time since his appointment as Energy Minister that Mr. Epp has addressed a CPA function. If you recall, he spoke at the CPA's annual dinner last spring (1989), under stressful circumstances. At that time a plane was waiting to return him to an emergency situation in Ottawa brought about, not by an oil leak, but by a budget leak.

Earlier this year, he addressed a CPA luncheon which originally featured Environment Minister Lucien Bouchard. On two days' notice, Mr. Epp helped us out when Mr. Bouchard became unavailable.

My sincere hope is that on this, his third presentation to the CPA, he will finally beat the jinx. I think it will be okay this time because three or four of us took the jinx out of this program by acquiring speeding tickets yesterday.

Ladies and gentlemen, I am delighted to introduce your second keynote speaker, The Honourable Jake Epp.

THE HONOURABLE JAKE EPP
Minister of Energy, Mines and Natural Resources
Government of Canada

SECOND KEYNOTE SPEECH

Mr. Kelly, Mr. Baldwin, ladies and gentlemen. Let me thank you and the Canadian Petroleum Association for the invitation to be here.

The theme you have chosen for the seminar—"Bringing it to Market"—reflects your industry's long-held vision of the enormous potential of the frontiers. It is within Canada's psyche and also, I imagine, within its folklore, that the North, and the frontier generally, holds a certain mystery for Canadians. It is part of our character, it is part of our national identity, and yet many have had very little personal experience with our frontiers. The group in this room is obviously one of the exceptions to that reality.

Your theme suggests optimism that we stand on the threshold of frontier development. You might say, "Well, it might not be that apparent when you consider the environmental or capital issues." But generally speaking, I see this very differently from approximately twelve years ago when I was standing on the shores of the Mackenzie River and speaking to a native who had his ATCO trailers on barges down on the Mackenzie. He thought that he would take advantage of the development that was going to take place along the Valley. He said to me: "Jake, now that I've got my investment down there, my banker is calling me. What do you suggest I do?" And those, I guess, are the practical considerations when one takes a look both at government policy and the realities of oil prices.

But the optimism is not limited to the industry. I believe we are seeing a widespread and dramatic change in perspective toward development, particularly among those who will be most affected by it.

The residents of Newfoundland, for example, are looking to development to diversify their economy and spur growth. Nova Scotians anticipate the benefits associated with the first oil production from the Cohasset-Panuke project. In the northern communities, there is a growing confidence that development can provide much needed employment and business opportunities, and, more important, that development can be compatible with northern and native lifestyles.

Clearly, "Bringing it to Market" depends on developing a strong consensus among all the stakeholders about how resource development can proceed. This consensus is growing, but it remains fragile. As we lay our plans for the future, it is absolutely vital that we direct our efforts towards maintaining and reinforcing this emerging consensus.

We all have our parts to play in this effort. But more than any other player in northern development, industry is in a position to make a decisive contribution. By listening to, and acting upon, the concerns of northern Canadians, by involving them in decisions that will greatly affect their lives, and by helping to shape inevitable compromises, industry can ensure that our resources are successfully brought to market in an atmosphere of trust and co-operation.

That is a significant challenge. For those of us who have had some experience with northern Canada and its people, it is not only a significant challenge but an opportunity. I, for one, see the opportunity differently today than I might have even ten years ago.

ESTABLISHING THE FRAMEWORK FOR DEVELOPMENT:

There are a number of themes I would like to touch upon today. First of all, establishing the framework for development. How do we do it and what is the framework? Let me take a few moments to outline what the Government of Canada has been doing to set the stage for frontier development. I want to look at the framework of government policy and where we are today.

Since 1984, we have moved deliberately to create a policy framework for long-term frontier development. This framework has four elements. First, the establishment of a market-oriented system that will serve as a strong basis for investment and growth for the oil and gas sector. It has to be market-driven.

I am reminded of a speech I heard at White Sulphur Springs, Virginia, where the FERC representative, who spoke before me, mentioned the market orientation of the industry and the prevailing view that government had simply to get out of the daily investment lives of the industry.

No sooner had he finished than someone in the audience stood up and said: "In view of your comments, when do you expect the Bush administration to come in with oil drilling incentives?" The entire speech said that they should expect the opposite. But whether south or north of the 49th parallel, I image old habits die hard.

The second element is the creation of a management and fiscal regime for oil and gas in the frontiers that is predictable, non-discriminatory and non-discretionary. That is difficult because of political pressures. While people recognize and feel that governments should not give in to those political pressures, you also know that you have people in your organizations today who are constantly monitoring the ebb and flow of these topics.

The third element is the creation of mechanisms for sharing control of development with those who, for the most part, will be affected by it. This is particularly true for those north of the 60th parallel.

The fourth element is the ongoing effort to redress the concerns of Canada's aboriginal peoples through the negotiation of comprehensive native land claims.

MARKET POLICIES:

Let me say a few words about each of these elements in turn. First, market policy oriented to the marketplace.

The market orientation was introduced in the Western Accord, the Natural Gas Agreements, and the Frontier Energy Policy, which remain the cornerstones of our policy for the frontiers. As part of that policy—a policy developed in consultation with your organization—we deregulated oil and gas prices, and exports. Domestic markets for natural gas are expanding, and, by continuing to deregulate, we will create more flexible markets for this fuel in the future.

In signing the Canada/US Free Trade Agreement, we removed most of the restrictions previously imposed on energy trade between Canada and the US. More importantly, we guaranteed access to our major market and significantly reduced the threat of US protectionism. This measure will, perhaps more than any other, provide a strong basis for future development.

We have also made changes in the NEB, specifically in its social cost/benefit analysis. People tend to look at the NEB in two ways—those who are being regulated by it, namely your industry, and those who see the NEB as perhaps the last chance to reduce or even to eliminate development. This issue is before the NEB. It will intensify, especially as we become more aware of environmental issues.

We improved the climate for foreign investment in the industry by replacing the Foreign Investment Review Agency with the less restrictive Investment Canada Act (I am fully aware of the special clauses related to this industry). At the same time, we have maintained a strong commitment to Canadian ownership and control of the petroleum industry. Under federal oil and gas legislation, firms or consortiums undertaking production on Crown land have to have at least a 50 per cent Canadian-owned component. This policy has been grandfathered under the Free Trade Agreement and will continue that way.

MANAGEMENT AND FISCAL REGIMES:

In terms of management and fiscal regimes, we have restructured the oil and gas management regime in the frontiers through the Frontier Energy Policy. Introduced in 1985, the policy established a system of land rights issuance based upon a single, quantifiable bidding criterion where the best bid wins. We have essentially eliminated the use of ministerial discretion in land issuance, and I hope we can continue on that path.

In addition, we have restructured the fiscal system by eliminating the Crown share, and by replacing the many NEP taxes with a profit-based regime that rewards success rather than effort.

As a result of these and other measures, the current fiscal framework for frontier development is now comparable to that for the North Sea, the offshore US and most other oil and gas jurisdictions.

SHARING CONTROL:

A fundamental principle underlying the policies of the Government of Canada—one which is of equal importance in developing a framework for frontier development—is that of national reconciliation through building better relationships with the provinces and the public. (When I speak about better federal/provincial relations, I am speaking of oil and gas, not other topics which might be getting public attention from time to time.) This reflects our belief that the development of Canada's resources must be accomplished through co-operation rather than confrontation. This is a time-consuming process, but one that is giving us better results. To build this co-operation, we have taken several steps that have as their raison d'être a broader sharing of management control.

The first and most significant of these initiatives was the Atlantic Accord. That and the subsequent offshore accord with Nova Scotia were designed to give the provinces and their residents a voice in the decisions that will affect their lives. The evidence of the past few years suggests to me that this approach is working.

We are also moving to involve northern Canadians in energy decisions. In 1987, we set the course by introducing the Northern Economic and Political Framework. Under the plan, the territorial governments will assume an increasing number of responsibilities formerly exercised by the Government of Canada.

For example, during my tenure as Minister of Health, we transferred responsibility for health care to the territories. This was done with co-operation and with relative ease. What surprised me at that time—being a former Minister of Indian Affairs—was that the Department of National Health and Welfare had more personnel north of 60 than had Indian Affairs at the time. That shows the kind of transfer that can take place.

With the signing of the Northern Accord Agreements-in-Principle by the Prime Minister in September 1988, we took a major step as Canadians toward devolving the management of northern oil and gas to territorial governments. I do not have a fear of moving or transferring that responsibility to territorial governments. As long as we all know the rules of the road and we don't get duplication, then I don't think it makes a difference if the rules are headquartered in Yellowknife or in Ottawa. Some of you, especially Albertans, might even think that Yellowknife is a little closer.

This step will give these governments management control over onshore oil and gas, and a share with the federal government in offshore management. It will provide territorial governments with the revenues that can form the basis for economic self-sufficiency. Most important, as in the case of the east coast accords, the agreements give northern Canadians a voice in decisions that affect their future.

I am very hopeful about the North. Let me tell you one other vignette. In 1979, we were negotiating a final land claim agreement with the Inuvialuit. At that time there were tremendous debates about how the Agreement-in-Principle would be put forward into final agreement (signed in 1984).

The very people who today are Ministers of Health and Ministers of Energy in northern Canada are the same people negotiating with us then. They are the ones who are in the forefront of development in northern Canada, both in their vision and their understanding of the need for development and economic growth for their people. This makes me hopeful about the future of the frontier.

Native Land Claims: Native land claims are a continuing issue. It is an issue that, I am sure, organizations like the CPA have spent more than enough hours in discussing, planning and possibly speculating on. But I think we, as Canadians, and native leaders, should take some credit for what has been happening. We have reached an Agreement-in-Principle with the Tungavik Federation of Nunavut or the Inuit of the Eastern Arctic. In addition, we have arrived at final agreements with the Indians of the Yukon and, most recently, with the Dene and Metis of the Mackenzie Valley.

These agreements provide the long-awaited certainty, which is a prerequisite for the massive investments that will be needed to develop our northern resources. Through these modern treaties, the rights of our native people have been guaranteed, and the ownership and title of northern resources have been somewhat clarified. The agreements, perhaps more than any other recent accomplishment, remove a major institutional uncertainty to northern development.

Getting agreements is not easy—especially when people have a history of taking a look at what agreements were signed in the past, how they were interpreted and how they might or might not have served their people. All three agreements, as I see it, are harbingers of a much more certain future.

COMPLETING THE AGENDA:

How, then, do we complete the agenda? Though we have made a great deal of progress in all these areas, our work is not complete.

The Northern Accord remains a major unfinished item on our agenda. The government remains committed to the Agreements-in-Principle and to the participation of northerners in development decisions. I share this commitment with my colleague, The Honourable Tom Siddon, Minister of Indian Affairs and Northern Development. Discussions aimed at finalizing the Northern Accord will begin soon.

I am confident that we will be able to establish a new political framework for oil and gas management that meets the needs of Canada and those of the territorial governments. By establishing a workable arrangement that provides efficient and professional management, we will create a stable investment climate within which northern development can prosper.

I would also like to see a similar shared management regime applied to the west coast offshore. I know these are touchy grounds when I start even mentioning a Pacific Accord. Such a Pacific Accord will need to deal with a heightened environmental sensitivity on the west coast. However, I feel we do need to put in place a joint framework by which environmental concerns can be addressed.

Finally, we will continue the good progress made to date on native land claims. Although final agreements have been reached in the Yukon and the Mackenzie Valley, there still remain some very important steps. The Dene/Metis have until March 31, 1991 to ratify their agreement and to make their land selections. Once ratified, the agreement must be approved by Cabinet before final legislation is drafted. As well, during the coming months, we will be pursuing a final agreement with the Tungavik Federation of Nunavut.

DEMPSTER LINK EXTENSION:

You will also have heard that the government has recently extended the Dempster Link Agreement for an additional ten years. This extension ensures that Canadian natural gas reserves in the Mackenzie Delta and the Beaufort Sea are provided with the Dempster option in the event that the Alaska Natural Gas Transportation System is completed.

In my view, the extension allows us to keep our options open at no cost to the taxpayer. It also reaffirms the government's commitment to the 1977 agreement between Canada and the US on principles applicable to a northern natural gas pipeline.

It is important to note, however, that this renewal does not give any company an exclusive right to build or operate a northern natural gas pipeline. Nor does it preclude any other party from submitting to the NEB a pipeline facility application proposing an alternative route. The NEB, in my mind, made a landmark decision on the export licence applications.

ENVIRONMENTAL CHALLENGES:

The area that is probably of greatest concern to us this morning, and one with the least definition, is the matter of the environment.

I have been outlining a framework for frontier development that the Government of Canada has worked to put in place over the years. There remains one final element of this framework to be considered. That element is the environment.

The impact of development on the fragile northern ecosystem has long been a central concern of northern Canadians, the industry and government. Today, however, we face a dramatically heightened level of environmental awareness and concern in both the North and in those regions that will be most affected by offshore oil and gas development.

As Minister of Energy, Mines and Resources, I continue to believe that access to secure, competitively priced energy is vital to our economic growth and employment opportunities. Not long ago someone said to me, "What are you going to do to reduce energy demands?" (This was in relation to electricity, but we are dealing with energy here.) I said, "Well, I think there are a number of initiatives that we can take—energy efficiency, energy conservation. But remember this: you expect energy ministers, both national and provincial, to have the lights on at the end of the day."

That is the balance that we constantly have to keep in mind. Sometimes, in public debate, that balance is not there. The issue, which is of very real concern to me, is how to achieve the right balance between economic and environmental considerations. We must ensure that, where the inevitable trade-offs are made, they are made in a manner that reflects a proper understanding of the nature of those environmental concerns.

I know we are under attack. When I say "we", I mean politicians first, industry second. It is interesting when you look at the polls. The believability factor of people who call themselves environmentalists is somewhat higher than that of your industry or politicians. They can say things that are possibly not sustainable in fact, but are still believed. This type of message may not be one that is popular in this room, but that's the way it is.

It is true that offshore drilling and production have a very good record of environmental responsibility. The same is true of oil and gas transport.

Your industry's reputation has been tarnished by the Exxon Valdez accident, and you now have a long uphill struggle toward environmental respectability in the public's eyes. Many of the actions that you take will be judged in the wake of that incident.

I have spoken of the fragile consensus that seems to be emerging in the North favouring development. In order to nurture this outlook, it is important that all of us—industry, regulators and government—ensure that our actions meet and surpass the expectations of all Canadians for the environment.

In my opinion, this is the greatest single challenge faced by government and industry. We have made it clear that our commitment to the environment is one of the most important priorities of the current mandate.

As you have heard from my colleague, the Minister of Environment, the government is developing a Green Plan that will serve as a basis for action. I want to say as well, and there might still be a popular notion in the room that the Minister of Environment is Marc Lalonde. From time to time I have heard rumours that somebody in government is trying to develop the son of NEP. I want you to know that this not what the Green Plan is about. The NEP used a poor approach; the evidence is clear on that. This approach would have the same success in the Green Plan as it had in the NEP.

We have already begun a consultation process. I encourage you to seize the opportunity afforded by this process to express your views on these very important issues.

GLOBAL WARMING:

I am not totally convinced that global warming also does not confront major international economic realities. At the recent White House conference on global warming, the Americans were trying to put some distance between public rhetoric and science, and were not very successful at it. What I found interesting was the kind of approach taken, because there were a number of related issues on global warming. For example: "Who's got the best technology, especially in computerization and satellite technology—the Japanese or Americans?".

There was another related issue, and that was the effect of CO2 abatement measures on North American competitiveness versus European, especially if we should raise the price of our energy products in our own markets relative to the price in the European market. There already are certain competitive advantages for Europe as they move to an integrated economic system in 1992.

There is no question that there is a third related issue. That is the developing world, which needs energy for development and will not want to pay either the political or the global price on the CO2 question. The developing world will expect others to share that burden.

The fourth related issue is Eastern Europe or Central Europe as it is comes out from behind the Iron Curtain. I thought one Eastern European delegate put it well, "We know we have pollution, we know we are affecting you, so in order to solve your problem—pay for ours." I am putting it in simple terms because I do not have time to elaborate, but those issues relate to the question of global warming.

At the recent Energy Ministers' Conference in Kananaskis, it was not a matter of rejecting the 20 per cent target, because no country has yet accepted that target. You might say Denmark has, but take a serious look at the Danish plan and how they might be able to reach the CO2 target by the year 2005.

What's interesting is that it leads to big increases in the price of energy products. Since the announcement of that plan, there has been a bad public reaction. There have already been public announcements by a number of political leaders in Denmark that the price attached to the plan is not necessarily one that the government is contemplating.

You can see that in this whole question, there are a number of issues to take into account. These have been highlighted by studies by a task force which was formed in 1988. There are certain projects that must be put into econometric models, excluding arguments about the future price of oil and gas, or the inflation rate, or the growth rate or Mike Wilson's interest rates.

Generally, we accept that a 20 per cent reduction of CO2 on the base year of 1988 would mean a reduction of projected CO2 levels by the year 2005 in the order of between 40-50 per cent. This is one real issue to consider.

The second issue concerns the DPA studies and their recommendations. The press has quoted me as saying that we would have to ban all cars from inner cities. Those were not my comments. That was one of the DPA's options: that there should be no cars in any Canadian inner city with a population over 250 000.

These are the kinds of considerations that the DPA factored in when they said we could meet the 20 per cent CO2 reduction. There were also others, and for Albertans this is important. They suggested, for example, that there would be no more thermal plants built, and that there should be electrification of all trains, which I said would be easiest because we are getting rid of the trains. Even with no more thermal plants and railway electrification and with energy conservation and efficiency, we are well below that 20 per cent and this will be the debate. I thought that Dr. Kenneth Hare, one of Canada's leading climatologists, put it best in his luncheon address when he said, "I think there is more debate among climatologists, in respect to this issue, than there probably is among politicians right now."

Do we have to move toward those goals? The answer is yes. The industry is saying the same thing. What those goals are and what the offsets are, I think, are important for Canadians to know up front as we enter the debate. The minute that I say this, I can easily be accused of trying to reduce the environmental agenda. This is not the case. For a guy who was Health Minister at one time and who was accused of trying to cleanse the world of all its sins, I find this new metamorphosis rather interesting.

EARP:

Let me just deal with EARP for a minute if I might. The responsibility of the federal government for environmental protection has been underscored by the Federal Court of Canada. In its most recent decision concerning the Rafferty and Alameda dams in Saskatchewan, the Court ruled that the guidelines set out in the Environmental Assessment and Review Process bind the federal government to assess all its activities for potential environmental impacts.

This interpretation has been re-affirmed by the more recent Oldman River decision. Here, the Federal Court stated that the guidelines must be strictly adhered to, and that they apply to any proposal that may have environmental consequences in an area of federal jurisdiction. Thus, an EARP is required for any project in which the federal government participates, or for which it has "some responsibility". This is generally in three areas: lands, money, or what is known as "significant public interest".

An example of the latter is the Vancouver Island Pipeline. There were two hearings on that because in the first the argument was that the Greater Vancouver Water District had not had sufficient input into the first hearing. Therefore, there was a second one, which might give you a bit of an indication as to how this was done. Governments must, of course, act in accordance with the law. As a result of these decisions, I have asked the NEB to examine its recommendations on a number of natural gas export licence applications, including those associated with Delta gas.

Making decisions on projects is difficult enough, and you have all had experience with that. The added dimension is how do you assess it as policy before the specific information on the project is available. These are issues where we have not, obviously, given you clear rules of the road.

The federal government announced in the 1989 Throne Speech that it would be introducing legislation to establish a more effective environmental assessment and review process. This legislation, to be known as the Canadian Environmental Assessment Act, will be tabled later this year. As Minister of Energy, Mines and Resources, I am concerned that this new process be both effective and efficient, and that it appropriately balance economic and environmental considerations. I am very interested in your views on this issue, and encourage your Association to make them known as the process develops rather than at the end of day.

CONCLUSION:

Throughout the country I sense a growing and broadening consensus favouring development in Canada's frontiers. This is not just the optimism of your industry. Nova Scotians anticipate the first oil project off their coast, and Newfoundlanders look forward to the Hibernia project. In the North, many communities have come to accept the idea that development is not incompatible with northern and native lifestyles and they are anxious to see development. This is a dramatic turnaround.

As we proceed in our efforts to "Bring it to Market," we must focus on maintaining and nurturing this positive view.

The key to this in the North is to increase the involvement of northern and native Canadians in the decisions that affect them. Industry has a major role to play in ensuring that native and northern Canadians have a meaningful say in the direction development takes.

In addition, we must jointly approach development with a new commitment to the environment. If we fail to do so, we risk undercutting the tremendous progress we have made to date. Industry, more than any other participant in the frontiers, will need to show an increased sensitivity to environmental concerns and project what that sensitivity means in practical terms.

Finally, let me wish you every success in this endeavour to bring the enormous potential of the frontiers finally to market. It is part of our heritage and part of our legacy. We are a country that is rich in resources. We are a country that is energy self-sufficient. When we look at the superpower just to the south of us, we look at the reality that today they import 46 per cent of their oil and/or gas. They speak to me about energy self-sufficiency while looking over their shoulders and saying, "How do we become less vulnerable as a world superpower?" Canada has a tremendous advantage and your industry has contributed enormously to it.

Thank you.

SESSION I DISCUSSION PERIOD

QUESTION:

Can you tell us about the federal government's revised Environmental Assessment Process

JAKE EPP:

First, I want to have clear rules of the road, as I said to you and others earlier. Second, I want to reduce or eliminate duplication as much as possible. Right now we have neither. Following the recent Federal Court orders, we also have a real fragmentation of jurisdiction. That being the case, we are now putting EARP through the Cabinet process. It has been a lot more complex than anyone thought it would be. I think we are now at the point where environmental impact is being done by quasi-judicial, regulatory bodies, such as the NEB. How does its process of application review and decision fit in an environmental process? Should it be entirely within the NEB process, or should it be separate, becoming part of the NEB process later?

In other words, does the NEB become the primary agent of environmental review, or does the NEB perform its traditional work in terms of approvals or rejections of applications? Or do the NEB and the EARP processes take place at the same time, with the results of both processes becoming one package of decisions for the company? You can see that, either way, you would have one process. This is where the debate is taking place.

I hope this gives you some direction about the principles involved, as opposed to giving you a specific indication of what government is going to do.

JIM KELLY:

I guess there are no further questions. This shows how well we received your speech and how well everyone understood what you said, Mr. Epp.

In closing, a few comments. Mr. Baldwin, we appreciate your coming here to support the Frontier Division and its activities, and we enjoyed your talk. Mr. Epp, you are a very highly informed Energy Minister—probably the most highly informed that we have had. We do appreciate your comments from your own perspective and the perspective of the Government of Canada. It was a great show, and we greatly appreciate your coming.

Thank you both.

SESSION II

FRONTIER POTENTIAL

INTRODUCTION:

DOUG STONEMAN,
Executive Vice-President
Shell Canada

Welcome back ladies and gentlemen.

My name is Doug Stoneman. I am pleased to be here and to be part of Session II, "Frontier Potential". I work for Shell Canada, and my involvement in the frontiers goes back a long way. It goes back to Liard River where Shell drilled a well that was notable for its absolute lack of success. Since then things have gotten better.

But it is indeed a pleasure to be here.

In Session I, we heard of the "Broad Perspective". Minister Epp and Chairman Doug Baldwin provided us with some guidance that may be helpful in the next few days as we consider "Bringing it to Market." Seven factors were mentioned, and we are going to begin to deal with the first of these factors.

For Session II, "Frontier Potential", we have three speakers. I propose that Roger Brundrit, Richard Dingwall, and Gary Bruce will give their presentations, after which we will have a question period. And then we will have lunch.

Our first speaker is Roger Brundrit. Mr. Brundrit joined Shell Canada in January 1965 as a geophysicist. Roger worked mostly in the frontier areas until 1975, when he was appointed Chief Geophysicist. Since then, he has held various management positions in Shell Canada, including Manager of Economics and Planning, and General Manager for Western Canada Exploration. He was appointed to his present position as Vice-President of Exploration for Shell Canada in February of 1990, following a two year overseas assignment.

Roger will address the general subject of exploration in the 1990s.

Please join me in welcoming Roger Brundrit.

D. ROGER BRUNDRIT
Vice President, Exploration
Shell Canada Limited

A SNAPSHOT OF THE CANADIAN EXPLORATION SCENE

Good morning ladies and gentlemen.

It was long after I agreed to make this presentation that I asked myself, "How does exploration contribute to 'Bringing it to Market'?" The initial job of the explorer to find threshold volumes has been more or less accomplished in four frontier basins: the Sable, the Jeanne D'Arc, the Arctic Islands and Mackenzie Delta.

Many companies are actively pursuing development options on three of these areas. Therefore, one may ask, "Why pursue any more exploration in the frontier until those areas are actively being developed?" One of the frequent answers, which applies to the Sable Basin, is that while the industry appears to have discovered sufficient productive capacity to support the necessary facilities and pipelines, there is not yet enough gas to keep that pipeline full beyond 10 or 15 years. Therefore, we must go out and explore for reserves that are not likely to be hooked up until 2010—even if the Sable area were to be onstream by the end of this century.

It is a chicken and egg situation: corporations are becoming less willing to fund frontier exploration until definitive development is underway; and developers, at least of gas, have difficulty concluding development plans without having even more reserves on hand. It is indeed an interesting and challenging topic you have chosen this week, and one in which explorers share a keen interest. In fact, if progress can be made on this issue we would see a revival of corporate interest in the funding of frontier exploration.

From my perspective, the frontier is not an isolated exploration environment. We have to consider it as part of the overall Canadian scene. For many companies, although not my local company, it must also be considered as part of the global scene.

There are two things that an exploration program needs. The funding of exploration is, of course, one of the fundamental requirements of an active program. The other is the expectation of a profitable outcome.

The major focus of this conference is on the second requirement, namely the profitable outcome, with discussions on development costs and marketing opportunities. But I want to spend at least some time on the issue of access to cash, which is highly important to an explorer. Frequently, explorers think it is their divine right to have access to all the cash they need to fund all of the worthwhile opportunities that they can conceive of. In times of real oil price increases and healthy margins, oil company presidents and their bankers have been pleased to fulfil these explorers' dreams...but times have changed.

The general consensus for the medium term is that while oil prices will be variable, they will also be capped at $22 or $23 US, West Texas Intermediate, with their margins under considerable pressure, particularly in the gas sector. Everyone now knows that exploration is not cheap—especially in the frontier.

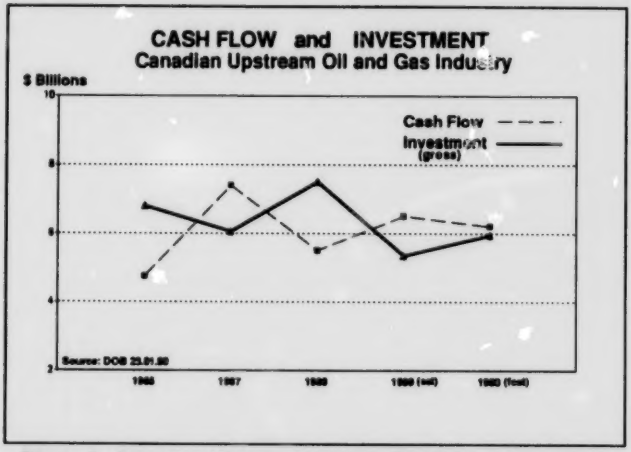


Figure 2 . Canadian Upstream Industry Cashflow vs Investment

It was against this backdrop that I noticed, in the January 23, 1990 Daily Oil Bulletin, a chart showing the cash generation ability of the Canadian upstream industry (Figure 1). Here we can see variations of $1-1.5 billion per year, mainly caused by fluctuations in oil and gas prices. The Daily Oil Bulletin then superimposed the investment level for the industry (Figure 2). There is a striking correlation between the investment level of one year and the cash flow of the previous year. For example, investment in 1988 was almost exactly equal to the cash flow for 1987. Apparently, the oil industry is unwilling to borrow in order to fund new investments. This is hardly surprising, considering the industry's rate of return was 3.6 per cent in 1988, compared to current prime borrowing rates of 14 per cent.

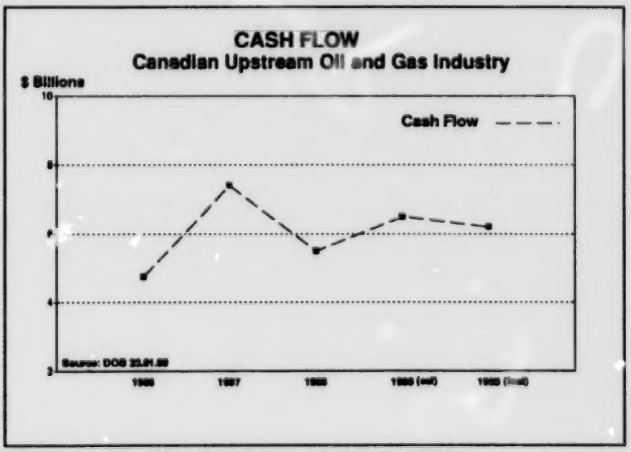


Figure 1. Canadian Upstream Industry Cashflow

Development and exploration expenditures each represent about half of the investment total, but development projects typically last two years and are less susceptible to budget cuts than exploration. The implication is that exploration investment in today's climate is subject to 20-30 per cent annual variations in funding. But while explorers must learn to cope with these variations, there are some things, and I will get specific later, that governments can do to alleviate the worst impacts of these funding restraints.

The second issue is how to decide where to invest the exploration dollars. Exploration managers are usually charged with two directives: find more than the company produces; and make sure that the investment makes a full-cycle profit. The first target is relatively easy to measure. The profitability directive, however, is much harder to measure. It is subject to the latest price prediction made by the corporate strategist, and it is also very sensitive to the unpredictable time delays between an exploration discovery and its eventual development, particularly in the frontier.

An alternative is to go behind the profitability calculation by looking at what drives that profitability. Some of these are:

- Prices of oil, gas and sulphur
- Availability of markets
- Undeveloped or underdeveloped resources
- Undiscovered potential
- Environmental sensitivity and concerns
- Development and application of new technology
- Competitive position of the corporation

Our industry has concluded that it is unable to forecast prices in the short and medium term (1-5 years), although we are all guilty of re-quoting to each other that prices will rise in the late 1990s. As a planning premise, however, I return to my earlier remark that oil prices will be variable but limited on the upside to $24 US for WTI or $30 Canadian at Edmonton. This may be a pessimistic assumption, since it is clear that the US, as the world's largest consumer, is experiencing a strong growth in its import requirements. Rather than use this fact as a basis for predicting higher oil prices, it is perhaps more prudent to assume that the US will be a receptive market for any surplus Canadian oil and a growing, but still competitive, market for natural gas.

Natural gas prices have declined more than oil prices. Current gas prices are at about 50 per cent BTU parity with crude oil, versus their historical position of 75 per cent or greater. Thus, there is realistic optimism that gas prices will firm up considerably in the medium term as the gas bubble shrinks and gas-to-gas competition declines. Environmental concerns in the marketplace should also favour gas, as it burns cleaner and produces less carbon dioxide than other fossil fuels.

On the other side of the coin is the impact that major new gas projects may have on the US market. If new supplies enter the US market at, say, 500 bcf per year increments—typical of a Delta or east coast project—then they would represent a 30-40 per cent step increase in imports, possibly leading to another mini-gas bubble until the market has fully absorbed that new volume.

Explorers are critically interested in the undiscovered potential of basins. The Western Canadian Basin is now one of the most explored basins in the world. It has been covered by several million kilometres of seismic and has been tested by some 150 000 wells. The opportunity to find a large oil accumulation is thought to be very small. In contrast, there are many prospective basins in the world that are experiencing their first round of exploration or, as in the East European countries, are becoming available for modern exploration after a 40 year hiatus.

These foreign basins have moderate exploration costs; they have expectations for large (100 mmb+) discoveries and low unit development and transportation costs. They also have significantly higher taxation or equivalent taxes, but given some success, the economics are considerably superior to Canadian exploration. Many Canadian, US and recently North Sea companies have recognized this and have expanded their international exploration efforts, often at the expense of local programs.

In the first half of 1989, for example, foreign investment by Canadian companies grew by 7 per cent compared to a 20 per cent decline in domestic investment. This does not mean that oil exploration in western Canada is unprofitable for everyone. On the contrary, it is likely to be very profitable for those with a competitive advantage in exploration costs and who are not trying to replace large quantities of production. In short, it has become a "niche" business—a "niche" where many companies, including the one I work for, are not comfortable. Low overheads, fast, intelligent decision-making, use of the latest seismic technology, including 3-D, and the ability to make deals are some of the prerequisites to success in the Western Canadian Basin.

Gas exploration, on a simple statistical basis, is also mature in Western Canada, but there are remote (and therefore expensive) and deep (also expensive) parts of the basin that are relatively lightly explored. These appear to be the areas where many major Canadian companies are now focusing their attention. The prospects of finding significant new fields in the structural plays are real, but with increasing competition, the costs are rising significantly above mid-1980 levels, particularly in land prices. Again, this may be a "niche" business where deep pockets, large, high-quality seismic data bases, a good land position, and the ability to work within environmentally sensitive areas are precursors to success. Alternative gas exploration strategies, based on innovative geological/geophysical modelling, can also be highly profitable and are less costly on an individual basis. However, one's company must be able to endure a significant number of disappointments between those highly profitable successes.

The NEP caused the completion of the initial rounds of exploration in the frontier basins. This activity, which some thought was a poor investment of

taxpayer's money, did at least establish that Canada could not rely on cheap and plentiful supplies of frontier oil for her liquid fuel demand. We are left now with the knowledge that one or two basins are oil-prolific, two or three are gas-prone and the rest are not prospective.

The Beaufort/Delta, Sable Basin and Jeanne D'Arc Basins all contain discovered reserves which approximate the threshold size for commercial development. It is unrealistic to expect that very aggressive exploration programs will take place until the development engineers and regulatory bodies can see their way to bring those discoveries into production at today's prices. I hope that some of my colleagues who follow me on this rostrum will provide insights into the progress on this issue. It is my opinion that the government must encourage all these fields to come into production, but it should avoid the overt subsidies which, as we saw in the NEP, tend to distort normal market-driven priorities.

Individual exploration investments in the frontier tend to be expensive. Companies must make full use of new technology to drive down those costs and to improve the chance of success.

I am glad to say that, occasionally, significant cost-reductions are possible in the Frontier. Shell's latest well in the Mackenzie Delta was drilled this winter for less than $8 million, compared with the $22 million we spent in 1986. People say that the 1986 well was deeper, took longer; therefore it cost more. But there are compromises that can be made, both by the explorer and by the development engineer or drilling engineer, to help in this cost problem. The reduction of dry-hole risk in the frontier is being accomplished through the use of large and expensive 3-D seismic surveys. These surveys typically take a year to record and process. Those on difficult land areas like the Mackenzie Delta are taking even longer.

This brings me to the issue of licence term issue. When a company wins a bid on frontier land, it has a play-concept in mind for which it then gathers the 3-D data. One year has passed. Interpretation, and convincing senior management may well cause one to miss the second drilling window, leaving the third year as the first available drilling time. If something goes wrong in that third year—one of the cash-flow hiccups I referred to earlier—then frontier exploration investments become prime targets for cuts and the lands may have to be relinquished.

This scenario should not be construed as suggesting that frontier explorers are losing interest. It only recognizes the realities that oil companies have limited funds and limited flexibility on how to invest their funds. Other things may also go wrong. The prospect may prove to be either too small or not there at all; someone else may drill nearby and disprove your trapping concept. A company may decide to drill only if others can share in the mob/demob costs or only if another rig is available in the area.

A drilling window of one or even two seasons is inadequate to cover these unfortunate but real reasons for delay. In times of low activity, longer licence terms would be beneficial to both the industry and the government,

whose aims are to establish and develop Canada's oil and gas potential. I was glad to read that the terms of the West Beaufort licences include an initial five year term.

Nevertheless, exploration of Canada's frontier remains an exciting challenge. All of that secret information is now available. The industry is not overly active in Alberta and we have the people to look at all that information. The land is pretty well all expired and, very importantly, the government has found a way of making regular sales so that companies who really want to can acquire the land and take advantage of those opportunities.

What are the critical success factors? The first and relatively simple exploration round of drilling big structures is over, so one needs innovative geological ideas. But the individual well costs consume such a large part of most companies' exploration budgets that those innovative ideas must also be realistic and be mappable on seismic. And one must have the guts to bid high enough to win the licence.

The exploration business in Canada has changed and continues to change. Western Canada's success will go to those who can define what it is they do best, and who are prepared to stop doing what they don't do well. Frontier exploration success will go to those who can focus on sound, technically-driven opportunities, who work in basins with moderate development costs, who can get the work done in the right time-frame. Success will also follow those who don't disappoint their management too often by drilling just because the land is expiring, and who are prepared to invest very patient capital. The Canadian exploration scene holds promises and pitfalls for us all—sounds a bit like a golf game!

DOUG STONEMAN:

Thank you Mr. Brundrit. Before moving on, I should observe that he is a better explorationist than he is a golfer. So we may have some success in exploration.

Our next speaker is Mr. Richard Dingwall with Mosbacher Operating Limited. Mr. Dingwall was born and educated in the United Kingdom. His career has spanned many years, many countries and many companies.

He worked for BP in Australia and Papua New Guinea. He has worked in the offshore drilling contracting and surveying business in the North Sea, and he worked for Brit Oil in the North Sea and Europe.

Richard emigrated to Canada in 1980 and worked in frontiers, international and basin evaluation groups for various companies. Currently, Richard is President of Mosbacher Operating Limited.

His talk is entitled, "Frontier Reserves". We look forward to hearing his remarks. Please welcome Mr. Dingwall.

RICHARD DINGWALL
Vice-President
Mosbacher Operating Ltd.

FRONTIER RESERVES

Canada is fortunate that within its geographic boundaries it embraces at least 10 major sedimentary basins containing large amounts of conventional oil and gas. Only one of these areas, the Western Canadian Sedimentary Basin, has been developed.

The remaining basins have been explored and several large and important discoveries made. But only one, the Norman Wells oil field in the NWT, is on permanent production. In Nova Scotia, the Beaufort Sea and the Arctic Islands, demonstration production projects have been completed or are continuing to show the feasibility of production from these remote and climatically hostile areas.

Since we met here two years ago the Canadian oil and gas industry has undergone a considerable amount of restructuring. And I wonder if this brings home some memories? In my particular case, I keep a paper copy in my office to remind me of the fragility and the dependence of a company's fortunes on outside influences. You might not be able to see the bottom but it's a one-man organization and the boss man is telling him they are going to make employment cuts.

Nevertheless, I think the industry was overdue for this reorganization. I think it had become far too complacent and depended on ever-increasing oil prices to mask that complacency. In addition, government grants and the maturity of the Western Canadian Basin disguised that inefficiency.

Today I have been asked by the CPA to discuss the controversial topic of frontier reserves. I thought for a long time about what frontier reserves actually meant, and talked to a large number of people and became really even more confused than when initially asked to give a paper. Everyone had different viewpoints.

I would like to note that most of the discovered reserves in the Canadian frontiers have only one well drilled upon each structure. We require many more appraisal wells before a full appreciation of the hydrocarbon potential can be realized.

The overview that I am presenting will give only a gross estimate of the discovered reserves, and an even more uncertain estimate of the additional potential remaining in the frontiers.

Between 1982 and 1987 the Canadian frontiers were the focus of a considerable amount of exploratory work. The emphasis has now moved to the pre-development and development engineering work for specific structures such as Amauligak in the Beaufort Sea, the Hibernia and Terra Nova oilfields

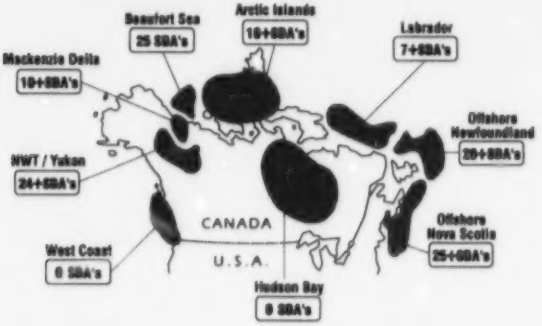
offshore Newfoundland, the Cohasset-Panuke oilfields offshore Nova Scotia, the gas fields in the Mackenzie Delta and Beaufort Sea, to addressing the problem of transporting these reserves to markets economically (Figure 1).

Although the frontiers have reached the first step along the road to development, the required infrastructure, the distance from markets and associated transportation costs will still prove to be major obstacles to development.

It is vital, therefore, that exploration continue. Without additional discoveries, sustained development will be impossible and lower costs will be very difficult to achieve.

SIGNIFICANT DISCOVERY APPLICATIONS

CANADA LANDS

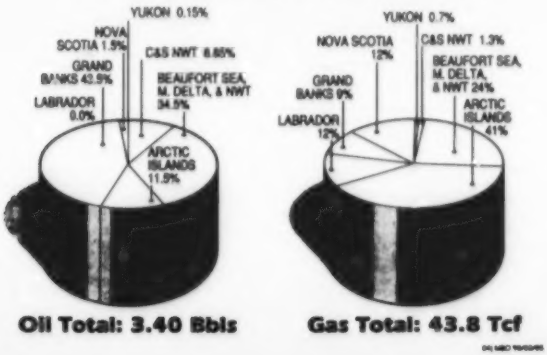


RESERVE BASE:

Exploratory drilling of Canada's frontier areas has a long history, dating back to the early 1960s when sovereignty claims forced the government to commence exploration in the far north. Considerable success has been associated with this drilling. More than 120 applications for significant discovery status have been made by the various operating companies within the Canada Lands to the Canada Oil and Gas Lands Administration (COGLA) (Figure 2). Based on a combination of public documentation and internal studies that we have done at Mosbacher, recoverable reserves for these discoveries are estimated at approximately 43.8 trillion cubic feet of natural gas and 3.40 billion barrels of oil (Figure 3).

TOTAL CANADIAN FRONTIER

CONVENTIONAL RECOVERABLE OIL & GAS RESERVES - EXPECTATION CASE

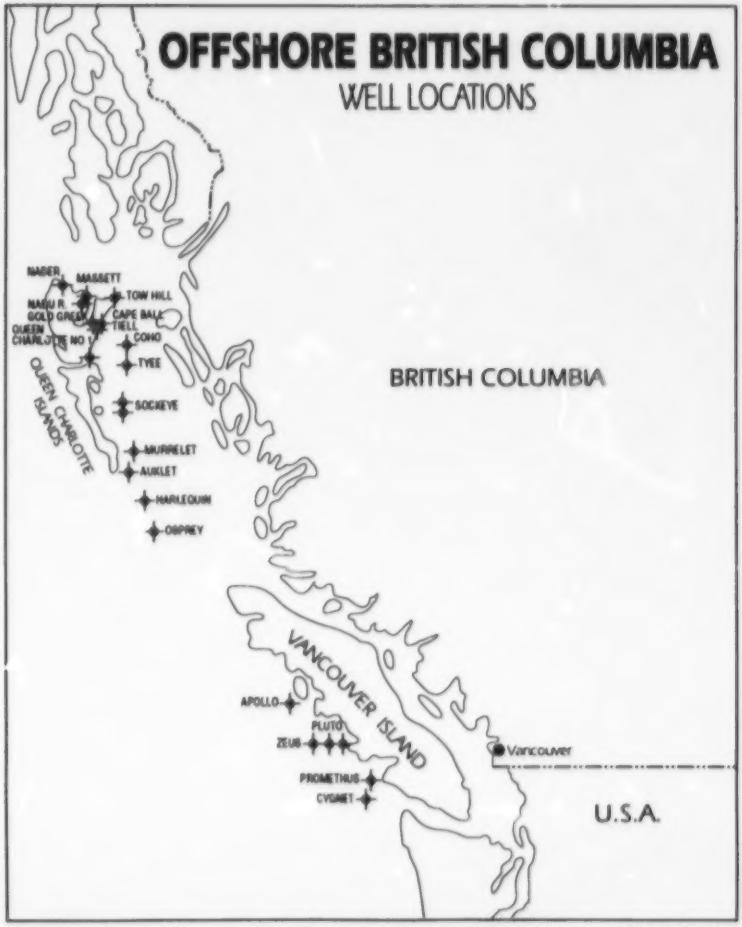


Oil Total: 3.40 Bbls **Gas Total: 43.8 Tcf**

Although it is recognized that the government agencies calculate considerably higher potential, it is on the above level of reserve figures that any development plans will be formulated.

Let us quickly review the reserves in the individual geographic areas that comprise these totals and attempt to add to these numbers a realistic assessment of the remaining potential.

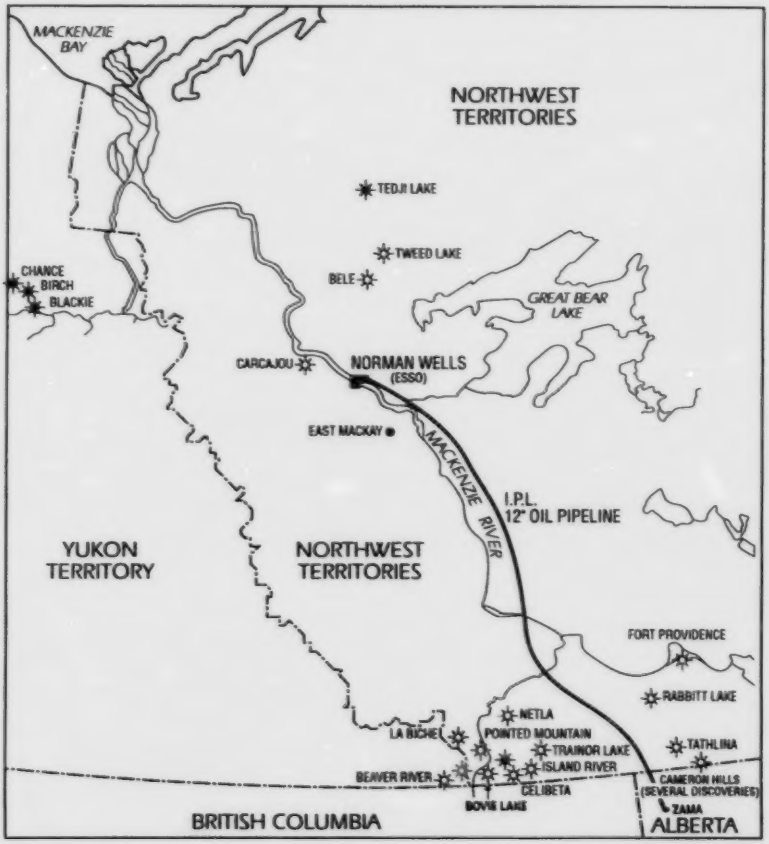
i. **Offshore British Columbia** A total of 14 offshore wells have been drilled with no significant discoveries made (Figure 4). Although both oil and gas shows have been recorded in several geological intervals, it is probable that the area is primarily gas prone. Potential reserves are estimated at 1 billion barrels of oil and 15 trillion cubic feet of gas.



ii. **Yukon and Southern N.W.T**. The only large, significant discovery is the Norman Wells oil field. This has been on production since 1985. The remaining discoveries are small gas fields, the majority of which are located in the southern portion of the area (Figure 5). Total recoverable reserves are estimated at 310 million barrels of oil and 0.8 trillion cubic feet of gas. Additional potential reserves of 500 million barrels of oil and 4 trillion cubic feet of gas have been calculated.

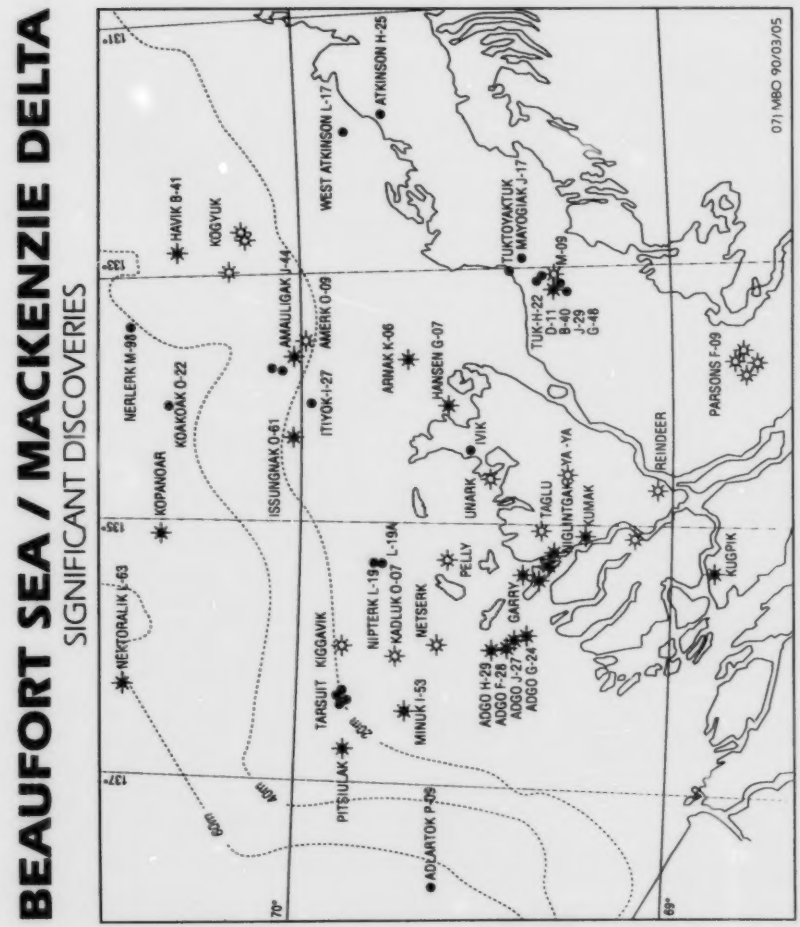
YUKON & N.W. TERRITORIES

SIGNIFICANT DISCOVERIES

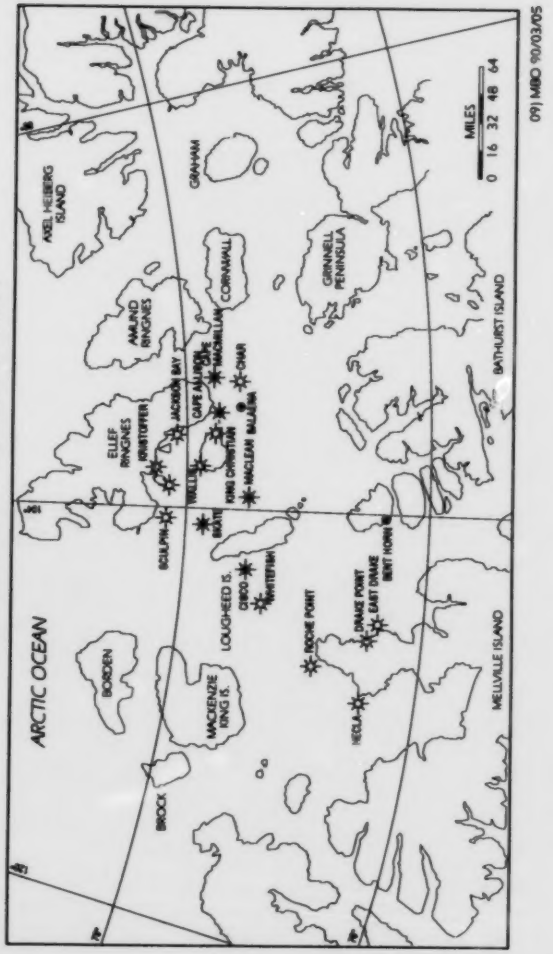


06) MBO 90/03/05

iii. **Mackenzie Delta/Beaufort Sea** More than 25 significant discoveries have been declared in this area (Figure 6) with recoverable reserves estimated to be in the order of 1 billion barrels of oil and 12 trillion cubic feet of gas. Additional potential reserves are estimated to be in the order of 2.5 billion barrels of oil and 24 trillion cubic feet of gas.

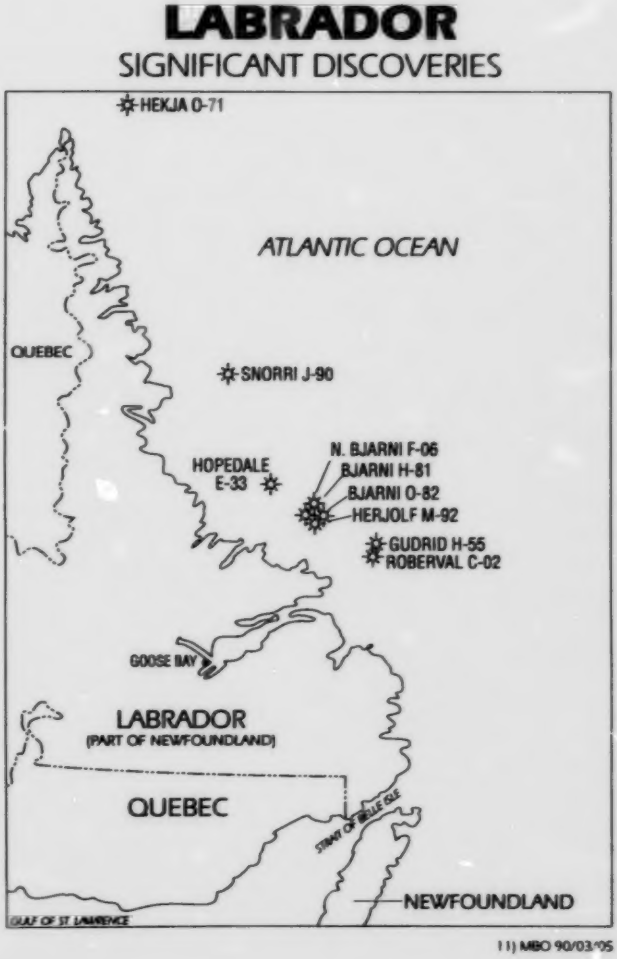


iv. **Arctic Islands** A large number of gas and oil fields have been discovered in this, the most northerly frontier resource area (Figure 7). Of these, Bent Horn produces, on a part-time basis, enough to fill 2 or 3 tankers per year. This is in the order of about 200 000-300 000 barrels per tanker.



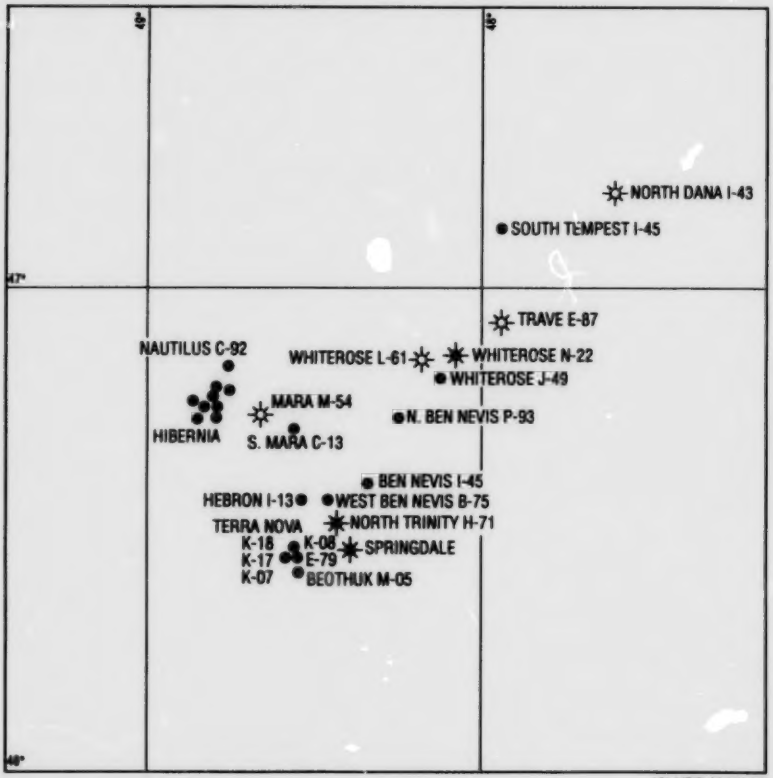
Recoverable reserves total 17 trillion cubic feet of gas and 455 million barrels of oil. Additional potential reserves are thought to be in the order of 15 trillion cubic feet of gas and 500 million barrels of oil.

v. **Offshore Labrador** A total of seven significant discoveries have been declared in this area (Figure 8). Gas reserves totalling some 5 trillion cubic feet have been calculated. Additional potential reserves are thought to be in the order of 7 trillion cubic feet.



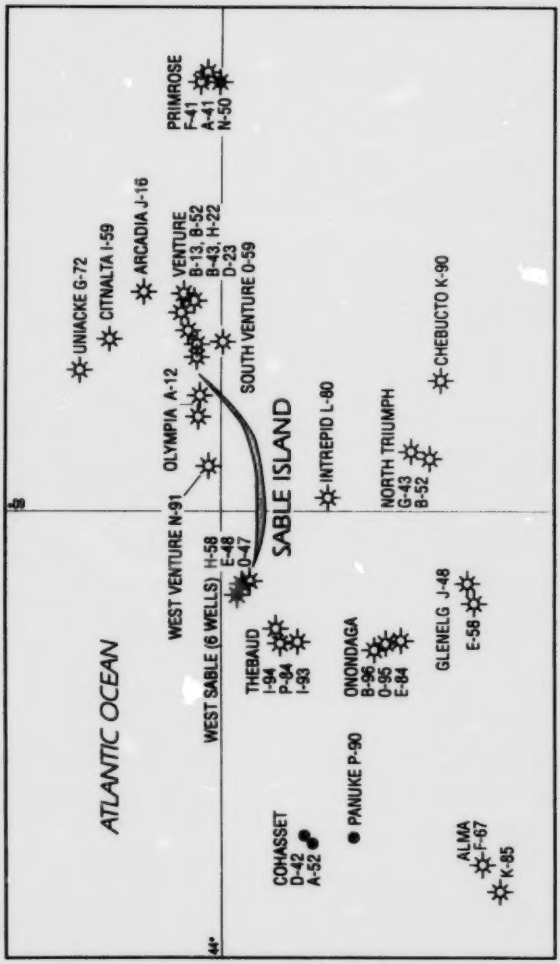
vi. **Offshore Newfoundland** More than 20 significant discoveries have been made in this basin which includes two of the largest offshore oilfields in Canada, Hibernia and Terra Nova (Figure 9). Recoverable reserves have been estimated at 1.5 billion barrels of oil and 4 trillion cubic feet of gas. Additional potential reserves are considered to be in the order of 3 billion barrels of oil and 5 trillion cubic feet of gas.

GRAND BANKS
SIGNIFICANT DISCOVERIES



13) MBO 90/03/05

vii. **Offshore Nova Scotia** A large number of gas and condensate discoveries have been made, primarily in the vicinity of Sable Island (Figure 10). Recoverable reserves are estimated at 45 million barrels of oil and 5 trillion cubic feet of gas and 91 million barrels of condensate. Additional potential reserves probably total some 200 million barrels of liquids and 8 trillion cubic feet of gas.

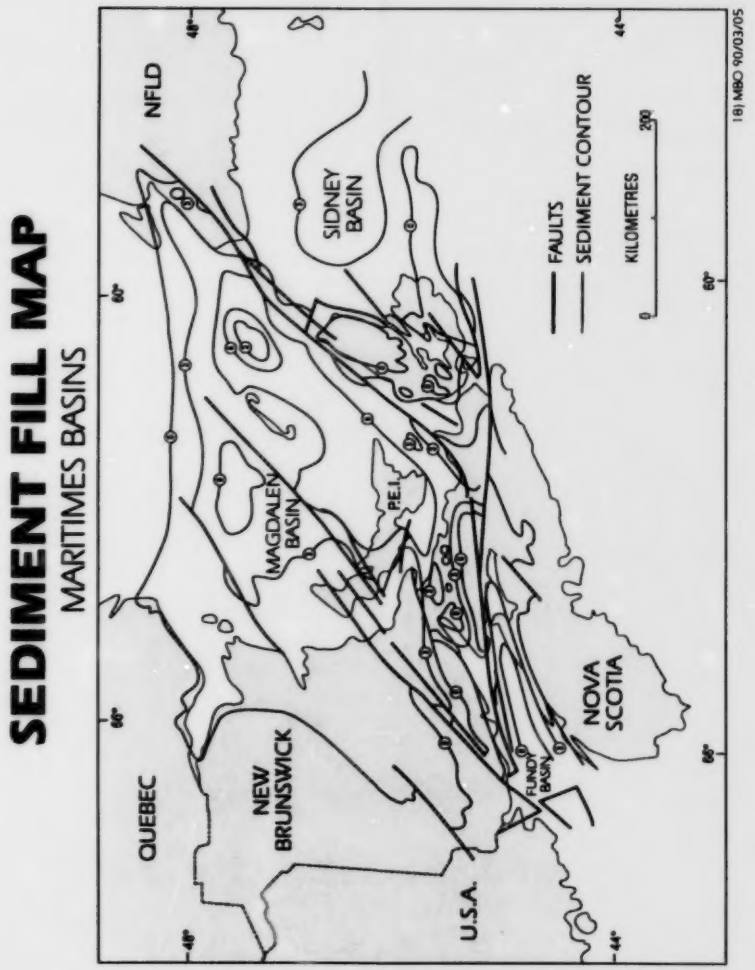


viii. **Hudson Bay Basins** Only five wells have been drilled offshore in this area. No significant discoveries have been made and the potential is considered to be minimal (Figure 11).

SEDIMENTARY BASINS
CENTRAL CANADA - HUDSON BAY AREA

17) MBO 90/03/05

ix. **The Maritimes** Only small gas accumulations have been discovered in this a ea. The additional potential is considered to be low (Figure 12).



SUMMARY AND DISCUSSION:

In summary, the estimated recoverable reserves are put at approximately 3.4 billion barrels of oil and 43.8 trillion cubic feet of gas (Figure 13) with an additional potential estimated at 8.2 billion barrels of oil and 79.5 trillion cubic feet of gas (Figure 14).

ESTIMATED RECOVERABLE RESERVES

AREA	LIQUIDS Bbbls	GAS Tcf
OFFSHORE BRITISH COLUMBIA	—	—
YUKON TERRITORY	0.005	0.300
CENTRAL & SOUTHERN NWT	0.305	0.500
BEAUFORT SEA / MACKENZIE DELTA & NORTHERN NWT	1.000	12.000
ARCTIC ISLANDS	0.455	17.000
LABRADOR	—	5.000
GRAND BANKS	1.500	4.000
NOVA SCOTIA	0.135	5.000
	TOTAL 3.400	**43.800**

ESTIMATED ADDITIONAL POTENTIAL RESERVES

AREA	LIQUIDS Bbbls	GAS Tcf
OFFSHORE BRITISH COLUMBIA	1.000	15.000
YUKON TERRITORY CENTRAL & SOUTHERN NWT	0.500	4.000
BEAUFORT SEA / MACKENZIE DELTA & NORTHERN NWT	2.500	24.000
ARCTIC ISLANDS	0.500	15.000
LABRADOR	—	7.000
GRAND BANKS	3.000	5.000
NOVA SCOTIA	0.200	8.000
HUDSON BAY / MARITIMES	0.500	1.500
	TOTAL 8.200	**79.500**

Figure 15 illustrates, by geographic area, the sum of the recoverable reserves and the estimated additional potential reserves that constitute Canada's total frontier reserve base. My estimate is 123.3 trillion cubic feet of gas and 11.6 billion barrels of oil. Government estimates are 268 trillion cubic feet of gas and 29.4 billion barrels of oil. A considerable difference.

CANADAS' TOTAL ESTIMATED FRONTIER RESERVE BASE

AREA	LIQUIDS Bbbls	GAS Tcf
OFFSHORE BRITISH COLUMBIA	1.000	15.00
N.W.T / YUKON	0.800	4.80
BEAUFORT SEA / MACKENZIE DELTA	3.500	36.00
ARCTIC ISLANDS	0.955	32.00
OFFSHORE LABRADOR	—	12.00
GRAND BANKS	4.500	9.00
HUDSON BAY	0.500	1.00
NOVA SCOTIA	0.335	13.00
MARITIMES	—	0.50
TOTAL	**11.600**	**123.30**

Neither set of figures, however, takes into account, first, a realistic assessment of a geographic area and its production capabilities in such a hostile environment, and second, the economic factors. If the geographic factors were taken into consideration, then, based on the above estimates, there would be only some 62.8 trillion cubic feet of gas and 9.135 billion barrels of oil to be recovered, of which some 21.8 trillion cubic feet of gas and 2.945 billion barrels of oil have already been discovered. These reserves would occur in the NWT/Yukon, the Beaufort Sea-Mackenzie Delta, the Grand Banks and offshore Nova Scotia. If the economic factors were added to this equation the numbers could be reduced significantly—perhaps to zero.

We estimate that some 41 trillion cubic feet of gas and 6.19 billion barrels of oil remain to be discovered, which is not unlike the reserves of the Western Canadian Basin, where some 70 trillion cubic feet of gas and 4 billion barrels of oil are thought to be recoverable.

It is also important, however, to inject some perspective into these figures. This can be illustrated by the amount of money spent within Canada in the last 25 years. A total of over 800 wells have been drilled at a cost of approximately $15.4 billion and vast quantities of seismic data have been generated. It is logical to expect that the majority of the larger structures have been tested, and that a large portion of the reserves have been found.

Exploration for the remaining reserves will not be based solely on measuring the size of the structure. Future work will require considerable technical co-operation between the geologist and the geophysicist with much

more emphasis being placed on seismo-stratigraphic interpretations to ensure that any drilling that takes place is located in the areas of optimal reservoir development of the basin.

We can also compare the pace of work in adjacent areas. Within approximately the same time period as exploration has taken place in the Beaufort Sea, the Prudhoe Bay Field was found (1968), put on production (1977) and is now on decline (1988). More than 50 states have benefitted from the estimated $40 billion (US) spent on developing this area. The US Federal government has received $24 billion in taxes, the Alaskan government at least $8 billion in taxes and the companies an estimated $40 billion after tax. The companies have found approximately 14 billion barrels of oil and 34 trillion cubic feet of gas in Alaska, in comparison to the 1 billion barrels of oil and 12 trillion cubic feet of gas found in the Beaufort Sea Mackenzie Delta area.

Additional potential reserves of 14 billion barrels of oil have been estimated for the ANWR lands and only 2.5 billion barrels of oil and 24 trillion cubic feet of gas for the Beaufort Sea/Mackenzie Delta. It is a distinct possibility that future North Slope development could, therefore, aid in the development of the Beaufort Sea-Mackenzie Delta.

Off the east coast of Canada, Hibernia, which was discovered in 1979, has been stalled for over 10 years; Terra Nova, which was discovered in 1984, is fast becoming a 10 year veteran; and Cohasset-Panuke is being developed by outside expertise. Within the same time-frame as these projects the United Kingdom has put 35 oil and gas fields on stream, and the British government has gained revenues approaching $150 billion (Canadian).

It is, however, unfair to make these direct comparisons without emphasizing the hostile environments in which the Canadian frontiers are located. By taking a measured and professional approach to exploration and by using demonstration production projects in most of these areas, companies have gained operating experience that will be vital for their safe development.

The above examples send a sobering message, specifically to the Canadian oil industry and, in general, to the future of the North American energy industry. These examples also contain a warning to the governments of both Canada and the US that control of their energy base is slipping out of their grasp, lured by the cheaper oil of the OPEC countries.

I would hope that this paper has helped to dispel the myth that the hydrocarbon resources of the frontiers are, by world standards, large. They are not. I have also attempted to show that these reserves are a vital component in the energy future of this country and probably also that of the United States. It is this North American perspective that will prove to be an important stimulus in seeing frontier production brought to the marketplace during the 1990s. Without a secure energy base the economic effectiveness of the North American trading bloc versus the European and Asian blocs could be in jeopardy.

DOUG STONEMAN:

Thank you, Richard.

The next speaker in our session is Mr. Gary Bruce. Gary was born and educated in Nova Scotia. He received an Applied Science degree from Acadia University and a Bachelor of Engineering degree from the Technical University of Nova Scotia.

He has more than 22 years of experience in the Canadian oil industry, in such areas as conventional oil and gas, oil sands, research and development, corporate development, and, of course, the development of Canada's frontier resources.

As General Manager of the New Development Department of Petro-Canada, he is responsible for Petro-Canada's development of oil sands and Canadian frontier assets. He is well equipped to provide an update on frontier development plans.

Please welcome Gary Bruce.

GARY C. BRUCE
General Manager, New Development
Petro-Canada Inc.

FRONTIER POTENTIAL: DEVELOPMENT PLAN UPDATES

Thank you, Doug. Ladies and gentlemen, good morning.

As I go through my presentation today, you will probably notice a bit of optimism in my voice. Since these don't seem like optimistic times for many people in the business, it would be worthwhile relating to you a true story about optimism and being an optimist.

In listening to today's speakers I have heard those words—optimism, optimist—mentioned more than fifteen times. I think it is appropriate that we really understand what an optimist is and what optimism is. With apologies to Doug, who is trying to keep this workshop on schedule, I will depart from my prepared and guaranteed time allotment. Also, apologies to my golfing buddies.

Yesterday, I decided to do some work on the golf course and with three other willing partners teed off around noon. As normally happens at the beginning of a new golf season, we were struggling. In particular, one of our foursome was having a terribly difficult time. In fact, his score on the first nine is probably one you'd be happy with for eighteen. Undaunted, we tackled the back nine. But luck and skill were not with this gentleman on this day. As we approached the sixteenth hole, I was beginning to feel a bit sorry. My pockets were full, but I was still feeling a bit sorry for this individual.

As I walked up to the tee, he said, "This is a hole-in-one hole. The sixteenth hole—140 yards." Not saying anything to him I thought, "I now know what an optimist is. This guy hasn't hit a green all day."

With that he selected a club—a driver. I thought, "Talk about an optimist! Now I know why this guy works in frontier development." However—and this is a true story—he made the drive and it went into the hole. It was a hole-in-one.

This story points out that with optimism and the will to succeed, things occur that may appear unobtainable. So for those of you who attribute my remarks today to an overdose of optimism, please remember this story.

The CPA Frontier Division has asked me, for this sixteenth Fairmont Workshop, to provide an update on Canada's frontier development projects. In preparing my presentation, I reflected on the present business environment in which developments are being planned, and compared today's outlook with what it was just over a decade ago, when I first became involved in the frontiers.

The business environment today and the forecast for the future are so different from what they were in 1979. It is worthwhile, then, to compare briefly the events and expectations of ten years ago with the key assumptions driving today's frontier development projects. This background, a review of the status of Canada's frontier development projects, will allow each of us to assess the opportunity of bringing the resources associated with these projects to the marketplace—the theme of this year's workshop.

Think back to a mere eleven years ago; it was a world very different from today, at least for those of us in the petroleum industry.

1979 was an eventful year, capping off a turbulent decade; some of the key events are shown on this slide.

The culmination of the Iranian revolution increased tensions in the Middle East and increased concern over the security of OPEC oil supplies.

Relations stabilized between Israel and Egypt, but Egypt was seen as a traitor to the rest of the Arab world.

The accident at Three Mile Island heightened concerns for energy supplies, particularly from nuclear power.

The Liberals regained power in Ottawa and, amid growing concern over foreign and domestic energy developments, would soon enact the infamous National Energy Program.

One of the largest hydroelectric projects in the world was brought on stream in Labrador.

The seizure of the US Embassy in Teheran reinforced concern about Middle East stability.

While these events were taking place, exploration in the Canadian frontiers, which began in earnest in the early 1970s, started to pay off.

The Hibernia field was discovered by Chevron Canada in 1979.

The Venture gas field was discovered by Mobil Canada the same year.

All of these events resulted in concerns over runaway oil prices, with some analysts predicting $100 per barrel oil by the year 2000. Higher oil prices, coupled with our growing dependence on OPEC for oil and increased oil consumption by North Americans, prompted exploration to identify and develop Canada's frontier resources. The Hibernia and Venture discoveries in 1979 and the later discoveries of Amauligak (1983) and Terra Nova (1984), all led to predictions of near-term development of frontier oil and gas.

But as we know, demand dropped, prices collapsed and our reliance on OPEC crude dropped substantially. The frontier projects that we predicted would come onstream in the 1980s were put on hold. The forces supporting today's predictions for oil and gas developments over the next ten years are, as I said earlier, quite different than those in 1979.

The price collapse of 1986, while initially disastrous for the Canadian oil industry and frontier projects in particular, has led to several factors that now support perhaps a more stable and demanding need for frontier developments. A number of these factors are captured on this slide.

Crude oil markets are stabilizing.

Most industry analysts are now forecasting that crude oil prices on a long-term market equilibrium basis will equal or exceed today's levels in real terms with a high probability of real growth in the short term.

World oil demand continues to grow. Strong growth is expected to continue in Asian countries. Improving Eastern Bloc economies could give a further kick to demand. In fact, strong demand is straining installed productive capacity in many parts of the world.

The North American supply/demand balance continues to deteriorate.

US supply has been falling since 1985. The US now imports some 42 per cent of its demand (7.6 million barrels per day).

Western Canadian light oil supply is beginning to decline. We lost 45 thousand barrels a day in productive capacity, and we didn't replace it. We are no longer able to supply market demand east of Ontario, and early in the 1990s western crude will gradually be displaced from Ontario markets as well. As Premier Getty said just last week, "Canada will be importing some 45 per cent of its oil as a minimum, early in the new century." This provides a natural outlet for east coast crude oil.

Frontier oil is a high-cost source of supply but engineering efforts are successfully bringing costs down.

The governments of Canada and the Atlantic provinces have provided strong support for Canadian frontier development. These governments recognize that potential regional benefits are very significant and warrant their strong interest. The important thing here is that there is a growing understanding between industry, government and regional bodies on how petroleum developments can be undertaken in harmony with locally established industries and the environment. Understanding is critical, if our business is going to establish the frontiers of Canada.

These factors, along with the hydrocarbon potential of the frontiers, suggests the 1990s could see the frontier areas of Canada begin to replace the Western Canada Sedimentary Basin as the major producing region in Canada. The projects likely to lead this shift are addressed in the next several slides.

Turning first to the Mackenzie Delta/Beaufort Sea, this area has captured the imagination of the Canadian public, as engineers and scientists, by developing technologies uniquely Canadian, have tackled the forbidding environment in a search for "black gold". The potential of the area as established by the Geological Survey of Canada is 8.5 billion barrels of oil and 66 trillion cubic feet of gas. We can assume, then, that existing discoveries today have only scratched the surface of this potential, even though 49 significant discovery areas have been awarded in the area (1.6 million barrels and 11.0 trillion cubic feet).

Two major projects, one gas and one oil, are evolving as the lead development projects.

Under the proposed Gulf, Imperial and Shell Mackenzie Delta Gas Project, three gas fields containing a total of 9.2 trillion cubic feet of reserves are slated for initial development. As shown on this next slide, there are several ways this gas could be delivered to markets some 2 300 kilometres to the south (Mackenzie Delta to Caroline).

Project participants recently obtained an export licence from the National Energy Board (NEB), which called for start of deliveries in the late 1990s at 1.2 billion cubic feet per day, or about 15 per cent of today's daily production of natural gas. Field development costs are projected at $4.7 billion in 1988 dollars, while pipeline costs to Caroline, Alberta could approach $4.5 billion. The key to this project will be a successful effort by the present participants to obtain long-term gas contracts at prices well in excess of current levels. As well, a number of issues face the consortium in the area of land claims, evolution of an oil and gas management system in the Northwest Territories and resolution of a number of environmental issues.

Many of these same issues are facing the proposed Gulf Amauligak Oil Project. Located 67 kilometres out in the Beaufort Sea in 32 metres of water, Gulf recently announced this field contains 335 million barrels of oil and 2.2 trillion cubic feet of gas.

Slated to be the lead oil development project in the Beaufort, the Amauligak participants are presently re-evaluating this $7 billion dollar project ($3 billion for pipeline and $4 billion for field facilities). Like the proposed gas project, the Amauligak oil project must face the economic hurdle of being more than 2000 kilometres from the market place with no transportation system in place. However, it is likely that Amauligak, together with other large oil fields in the Beaufort Sea (Adlartok and Kopanoar) and smaller oil fields on the Tuk Peninsula, will lead the way in establishing the Mackenzie/Beaufort Sea as a major oil producing area in the next century.

ARCTIC ISLAND DEVELOPMENT PROJECTS

Just as the establishment of transportation systems will dictate the pace and direction of development in the Mackenzie Delta/Beaufort Sea, transportation will have the same effect on the development of Arctic Island prospects. This region is not only a hydrocarbon frontier, but the last true geographic frontier area of Canada. With potential oil reserves of 4.3 billion barrels of oil and gas reserves of 80 trillion cubic feet, the industry, led by Panarctic, has only discovered a fraction of this potential (discovered reserves of 41.3 million barrels of oil and 15 trillion cubic feet of gas in 19 issued significant discovery areas).

Panarctic has the honour of producing to market the first crude oil from Canada's frontiers. Since 1985, Panarctic has produced approximately 200 000-300 000 barrels per year from its Bent Horn A-02 well on Cameron Island. This 42° API oil is moved via the MV Arctic and shuttle tankers to Montreal. The project has demonstrated the feasibility of production from the Arctic; however, further advances in technology along with much improved crude and gas prices will be required before year-round commercial production can begin.

OFFSHORE NOVA SCOTIA DEVELOPMENT PROJECTS

While production from the Mackenzie Delta/Beaufort Sea and the Arctic Islands appear to be some way off, a development proposal has recently been made in Nova Scotia that could see production commence from the Scotia Shelf before 1993.

To date the Scotia Shelf has proved to be gas prone with 23 significant discovery areas issued, containing 5.7 trillion cubic feet of gas and 144 million barrels of oil. It appears, however, that oil will be the first hydrocarbon produced from the Scotia Shelf with LASMO Nova Scotia Ltd. and Nova Scotia Resources Ltd.'s recent development application to the Canada Nova Scotia Offshore Petroleum Board.

Their proposal entails the development of the Panuke and Cohasset fields which together contain approximately 30-36 million barrels of recoverable 54° API oil. Located 45 kilometres southwest of Sable Island in 40 to 46 metres of water, the development proposal calls for utilizing a converted jackup drilling and production unit along with a steel well jacket at Cohasset and at Panuke. The fields will be connected by production, water injection and utilities flowlines. Production will flow to a field storage tanker.

Crude would be moved to eastern Canada or the eastern US by shuttle tankers over the months of April through November. It is expected to cost some $150-$200 million to develop the two fields, and $450 million in operating costs for the six years the system will remain in operation.

The major gas project being discussed today is the Scotia Shelf Gas Development Project. Located near Sable Island, this project would involve the development of six gas fields containing 3-4 trillion cubic feet of gas at rates of up to 300-400 million cubic feet a day. Using fixed platforms, the gas would be compressed to a Nova Scotia landfall through a two-phase pipeline. Here the gas would be processed for sale in the Maritimes and the US Eastern Seaboard with gas liquids sold domestically and shipped to international markets. At a total project cost of $4-5 billion ($ 1990), this project, like those in the Mackenzie Delta, awaits substantially improved gas prices.

OFFSHORE NEWFOUNDLAND/LABRADOR DEVELOPMENT PROJECTS

Turning to the Offshore Newfoundland/Labrador area, it appears the Grand Banks, with potentially recoverable oil reserves of greater than 11 billion barrels, will become the largest frontier oil basin in Canada. While Offshore Labrador, where six significant discovery areas have been granted, contains essentially gas (4 trillion cubic feet), the Grand Banks has been proved to be primarily oil prone with discoveries to date of some 1.8 billion barrels of oil and 3.5 trillion cubic feet of gas.

The deep water and harsh environmental conditions of offshore Labrador require major advances in technology before production can be generated in "Iceberg Alley". The Grand Banks area, on the other hand, appears poised for major oil developments, with the Hibernia project likely to lead the way.

The Hibernia project, located 315 kilometres east of St. John's, Newfoundland in 80 metres of water, was discovered in 1979 and was granted a development permit in 1986. It is estimated to contain 525 million barrels of recoverable oil which, by the way, makes it the fourth largest oil discovery in Canada and the largest field discovered in the past 20 years. Production is slated to begin in 1996, 17 years after its discovery. The Hibernia field could be the forerunner of major offshore developments in this area. The project is anticipated to cost some $5.2 billion to construct before start-up, before any cash is expected to flow back to developers. Approximately 110 000 barrels per day will be produced initially through the production system shown on this slide.

Developing Hibernia is a massive endeavour incorporating some major improvements in existing technology. Typical of the technology to be employed is the Gravity Base system, a 111 metre high and 100 metre wide concrete structure weighing more than a million tonnes and designed to withstand the impact of icebergs and severe storm waves. The project sponsors and the two governments, Newfoundland and Canada, are just now finalizing the various fiscal terms and benefit provisions of the project. Major field work may begin this summer on the project.

Some 35 kilometres southeast of the Hibernia Field is the Terra Nova field. Discovered in 1984, this project has estimated reserves in excess of 300 million barrels. This would place it about the seventh largest oil pool discovered in Canada. The project sponsors are now completing conceptual engineering studies. Final engineering decisions are expected to be made this year. The field size, among other considerations, favours the use of the floating production system shown in this next slide.

Using subsea gathering systems and either a semi-submersible with field storage or a mono-hull floating production system, the Terra Nova field could produce an average of 75 000 barrels per day upon start-up. If the consortium decides to proceed with a development application to the Canada Nova Scotia Offshore Production Board later this year, the project could be producing by the mid 1990s. Project costs to start-up are expected to be in excess of $2 billion.

This completes my review of development prospects for the hydrocarbon frontiers of Canada. By the late 1990s, we might see the Grand Banks and Scotia Shelf oil projects producing 20 per cent of Canada's light and medium crudes; the Mackenzie Delta/Beaufort Sea projects under construction; Scotia Shelf gas projects well advanced; and new technologies driving the development of the Arctic Islands and Offshore Labrador projects.

However, aside from the uncertainty of oil and gas prices, a key to development will be a concerted effort by all parties—governments, public interest groups and oil companies—to resolve a number of major issues facing us.

This CPA frontier workshop provides a forum for all parties to address these issues, and I commend the organizers on putting together an excellent agenda. Thank you for the opportunity to share some of my thoughts with you here today.

SESSION II DISCUSSION PERIOD

DOUG STONEMAN:

Gary, What is your opinion on the feasibility of frontier development in a free-market economy, when there is so little cash around for mega-project development in Canada?

GARY BRUCE:

Thank you for a difficult question that certainly most major oil companies have to deal with. I don't have the total answer. There is only a certain amount of money available for companies such as Petro-Canada and others involved in the frontiers and oil sands, and we can move forward with only so many opportunities.

In addition, there is an interest on the part of the oil companies to maximize the benefits received by the regional economies that are going to be impacted by development and this often increases substantially the cost of mega-projects.

I believe that since demand for oil, in particular, is growing and Canadian oil supply is dropping, there is the possibility for a number of mega-projects to proceed on a parallel path despite the high cost. However, I think we need more new investment coming into these areas before additional frontier and oilsand projects begin to take shape.

You know the frontiers, in particular, have a pretty select group of investors. There are few companies working in this area, and it is difficult to generate excitement without some development occurring to entice others into this business area.

Early in the 1990s, the changing crude oil supply situation and the first frontier offshore project coming on stream is going to entice new capital to enter the frontier areas. This will provide a major thrust, which should allow a number of mega-projects to proceed in parallel.

DOUG STONEMAN:

What is a reasonable exploration term for the frontier?

ROGER BRUNDRIT:

I think that a five year term for offshore is reasonable. I worry that three years would not allow a company to do the right kind of job in an offshore environment. In most of the offshore you can only drill, or would much prefer to drill, in the summertime.

DOUG STONEMAN:

Richard Dingwall, you were very courageous in your forecast of potential frontier reserves, when you talked about the problem of defining what a reserve is. You did mention some differences between what you were offering and what the official estimates are. Perhaps you would like to elaborate a little on some of the differences and what the implications of those differences are.

RICHARD DINGWALL:

As you can see from my talk, I tried to itemize, field by field, the inherent reserves. If you review the geology/geophysics data of the individual fields, you see that they are highly faulted. When I was here two years ago, I said every geophysicist has to have three faults on his map. I think we must have at least twenty geophysicists working on one field because each field seems to be segmented into small fault compartments.

Now technically, a well within one of those segments does not necessarily mean that the hydrocarbons extend over the complete structure, as mapped by the geophysicist. I have taken what I consider to be the conservative approach on that particular aspect of it.

The second aspect is that I discounted many claims made for reserve estimates made in the early 1980s—that is, during the last major phase of exploration in the frontiers. I couldn't really believe, from a technical perspective, some of the comments that were being made about the individual basins within the frontier at that stage. I still don't. With a wave of their hands people were asking for hundreds of millions of dollars to drill wells that may have even been under the permanent ice-pack.

To me that was not logical, first from a financial perspective. Second, the geology—even using a basin-wide analysis—was technically incorrect. (Perhaps that comment is a little harsh, but at that stage of the game you could still put together a realistic picture of each of the basins and select sensible acreage.) Perhaps I am being ultra-conservative, but I would prefer to attack the frontier development in that manner than throw money at it.

I don't think those days are around any more. One has to be very cost-conscious and adopt the most cost-effective manner to get these reserves to the market. I hope I do not sound pessimistic but I am trying to be realistic. People should understand that the reserves are there, but they are not necessarily in giant pools by world standards. They are in pools that can be managed with improved technology and innovative financing methods, as Gary has discussed.

In some of these areas there might be a need for some help from governments, if they deem it necessary. I would prefer, however, to see these reserves developed with company skills not government subsidies. Having said that, I do see these reserves as part of the overall North American energy scene; these reserves form a critical part in the North American energy scene and the rapidly emerging North American trading bloc (Mexico, Canada and the US).

DOUG STONEMAN:

By any measure, official or individual estimates of the potential are very large, and certainly the challenge is to be able to bring that to market. The second part of the question is, What are the implications of the differences in these estimates? I think Roger in his talk suggested that all of the basins should be pursued. Would you agree with that, Richard?

RICHARD DINGWALL:

From a pure exploration view point I could agree with that generalized statement, but I think it comes back to a question of economics. Which basins should we pursue? Some might be pursued when I am dead, others might be pursued right now.

Doug, in my opinion, there are certain basins — Nova Scotia, offshore Newfoundland, the Beaufort Sea, the Mackenzie Delta, and the Northwest Territories — where there are realistic expectations for additional reserves. Those basins have at least technically competent thresholds that we can work with.

The technology is there. We obviously need some long-term demonstration production projects. This is an excellent way of executing some of these projects. You have to learn. No one else around the world has the expertise of developing areas like the Canadian frontiers. I think Canadians are far ahead of anyone else, but there are always surprises that cannot be planned for.

My suggestion, then, is that caution be exercised in some of these areas, especially in view of what Mr. Epp and Mr. Baldwin have said earlier about the environmental agency that could appear very quickly on the horizon.

DOUG STONEMAN:

Roger, I would appreciate any comments you might have on what Richard has just said, but I'd also like you to answer this question: Have the biggest fields already been found? Do you expect to find any higher quality — that is, more economic — pools?

ROGER BRUNDRIT:

First, let me comment on Richard's remarks. When I said that all opportunities should be pursued, I meant those basins where the threshold reserves have been found. I did not mean running out and doing a lot more exploration in Hudson's Bay. My message was that the government should put in place regimes that would encourage the owners and the finders of those reserves to go out and see if they could pursue development, as opposed to a government deciding in advance that Hibernia was the one to develop and, therefore, putting all resources into that one. It is important that all developers be encouraged to be innovative about their particular resources, and to see whether those developments, in fact, turn out to be the most economic.

As to future field size, a 500-million barrel field has to cover a fairly large area. I am not sure that there are many 500-million barrel fields in the frontier that have not yet been tested. Go one size smaller to the 200-300 million barrel level, though, and I think there is lots of opportunity. They probably won't be in simple, easy-to-define structural traps because if they were, the NEP would have ensured their discovery.

However, they could be in very fine, very high quality reservoirs that are seismically mappable; otherwise the risks of failure becomes too high. You can't be drilling blind into stratigraphic traps. But, if you can find a stratigraphic trap on seismic you have probably found a very good quality reservoir. I don't think they will turn out to be billion barrel discoveries. Certainly, though, 200-300 million barrels of high quality reserves and high productivity are possible. That's what we are looking for.

DOUG STONEMAN:

That is encouraging, Roger. A previous president of our company said that we were looking for elephants. So perhaps there are still some elephants out there.

I have a question for Gary Bruce. It relates back to something that Richard pointed out to us — the pace of activity and development of discoveries in the North Sea versus Canada. How do you see the development costs of Grand Banks oil as compared to those of similar size discovered in the North Sea?

GARY BRUCE:

That is a difficult one to answer. I want to tackle it by getting away from the sphere of profitability and talking about supply costs—what you have to receive for a barrel of oil so the cash that you take out of one pocket and put into the project equals the cash that you take out of the project and put into your other pocket. Supply costs don't include government take, and as I said, they don't include any return on the project.

In comparing recent supply costs in the North Sea with projected costs for the Grand Banks, we feel that some of the pools of both the North Sea and the east coast will have supply costs around $10.00 US per barrel in today's dollars. However, the spread on the east coast is larger, with some having a supply cost of $25.00 US per barrel whereas, in the North Sea, the upper limit is around $15.00 US per barrel.

Another reason why we project higher supply costs for most of the pools in the Grand Banks versus those in the North Sea is that we don't have the infrastructure in place to allow for efficient development. The first projects will take a big hit on costs, but they will also develop that infrastructure. However, it is encouraging that the Grand Banks pools appear to be far larger than the ones that we now see being developed in the North Sea.

In the North Sea we are now looking at 40-60 million barrel pools for development. Today, in the Grand Banks, we are looking at one project at 525 million barrels, another one in excess of 300 million barrels and, as Roger noted, there may be many more of those 200-300 million barrel oil pools yet to be discovered. An interesting statistic, already noted by Richard today, is that the frontier sedimentary basins in Canada are about twice the size of the Western Canada Sedimentary Basin.

We have drilled 800 wells in the frontier areas in total. By comparison, we drill 5000-8000 wells in the Western Canada Sedimentary Basin in a single year. This gives you an idea about how much we really know about the potential. It is quite amazing what we have discovered in the frontiers with so few wells.

GARY BRUCE:

Infrastructure costs are a major cost of frontier development, if the infrastructure is not in place. Today, there are some things that we can build offshore much more cheaply because of an existing infrastructure. We can bring them into Canada for use in developing our east coast pools and get a lower supply cost. There is obviously, however, a desire on the part of industry, local business and local government bodies to establish the infrastructure in the area of development, whether that be in the Beaufort Sea area, the Arctic Islands area, or Nova Scotia/Newfoundland.

In offshore Newfoundland, we have enough reserves to initiate oil development now. The Hibernia project is the lead project, and a number of discussions have taken place between the federal and Newfoundland governments and the oil companies on how this project will be developed. Many of the discussions have centred on developing an infrastructure that will then allow projects following Hibernia to be brought on stream at a lower cost. Those benefit discussions are now being concluded between the two governments and the proponents of Hibernia.

The direct answer to your question is that we have sufficient reserves in the Grand Banks to justify the investment of many billions of dollars by Canadians and oil companies to get a project going. The project will then provide an infrastructure capable of allowing other pools to be developed on an ongoing basis, providing long-term employment and benefits to all Canadians. Reserves in other Canadian frontier areas are not yet large enough to justify the cost of the infrastructure required for development.

RICHARD DINGWALL:

Perhaps one way to look on the northern developments is to step back. You are talking about 2000-3000 kms north of here. I don't think there is enough investment capital available to turn around suddenly and say, "Whoa, we are going to do the whole thing in one step." If I understood the submission to the NEB, it is a phased approach. To me, this phased approach can be used in any of the other frontier areas. It will be a learning process in every area of the frontiers, especially in operations.

I can see the North being developed in possibly two or three steps. I am concerned that we might make a decision based only on economics. There is still an awful lot of other aspects to consider such as a process for working with governments. Every jurisdiction has its own way of doing business. This is vital to the well-being of the northern frontier, in particular where the onshore area is involved. The east coast offshore is a little different, but in the northern area

people live right next door to where you are going to pump oil and gas out of the ground. The impact from a personal perspective, therefore, is much greater.

DOUG STONEMAN:

I guess you are saying that we should no longer say, "Okay, we have four Amauligaks here, so let's build a large pipeline for the markets." You are saying that reserves could actually be smaller than anticipated, so let's try to keep costs down.

RICHARD DINGWALL:

Yes, that is what I would suggest. According to what Doug said, you have to plan for the long range, taking into account certain contingencies and flexibilities that are phased, rather than everything being done at once.

DOUG STONEMAN:

In terms of being competitive, one of the reasons why development has occurred in some parts of the world, like the North Sea recently, is that a different approach has been taken in the design of structures, etc. What about the route of technology? Is there some opportunity for a reduction in costs so we can bring these reserves to market against the competition of a world price in the teens? Do you see some technological breakthrough that could be helpful?

ROGER BRUNDRIT:

Certainly, it's true in the Mackenzie Delta. In the Unipkat well we were able to test about 85 per cent of the respective section at about one-third of the cost we had previously paid up there. There was a technology switch from year-round drilling platforms to an ice-based platform. Then there's the use of 3-D seismic to reduce finding costs. I don't think that new technologies have a huge impact in terms of an individual company's desire and willingness to carry on exploration in the frontier. Nor do they greatly affect the final development costs, which are in the $10-$25 per barrel range.

There is one other difference in exploration, and that is the quality of the reservoir. I am concerned that the Canadian frontier fields, though they are very good, do not stand up to the quality of fields elsewhere in the world. In fact, most of the newer fields in the North Sea are more highly productive than the fields we talk about offshore Newfoundland. Therefore, in one sense we are starting from a slight competitive disadvantage.

But regarding the actual use of new technology to drive down development costs—I will have to pass the buck on that one.

RICHARD DINGWALL:

While Roger has outlined the exploration side, this topic quite easily falls into two camps from a technological perspective. One is exploration and the other one is, I hope, what Gary is going to talk about.

From the exploration side there are a couple of points that I would emphasize. First, even if the use of 3-D seismic is very expensive, it still costs far less than a well.

Second, the pure exploration plays that were drilled during the NEP had the advantage of making companies drill quite deep and really examine horizons that people had never previously looked at. We can now determine the prime interval and write the others off. At least that is one advantage of the NEP. As a result of that work, companies can key their exploration program to certain horizons. In a sense, companies are not doing pure exploration, but more like exploitation. That can save a lot of money. It is not a technological jump, but it is a cost-effective way of looking at these areas.

If the geologist and the geophysicist cannot find anything bigger, then there is probably nothing any bigger there, and some innovative approaches need to be taken. Over to you, Gary.

GARY BRUCE:

Technology is essential to frontier development. We had to develop new technologies before we could even get into the Beaufort to explore. There have been some unique gains made by Canadian companies that have adapted existing technology. Technology evolves slowly, bit by bit.

The key for east coast developments is going to be technological improvements that will reduce costs. For example, this summer on the Grand Banks, the Terra-Nova partners will drill and put in a cased glory hole, which we think will be successful. We are going to plagiarize a bit on some work that was done in the Beaufort Sea. However, we are applying that technology in a different way. This has the opportunity of saving us considerable costs in the long term, perhaps millions of dollars compared to existing methods of protecting wells. This type of technological evolution will lower costs and spur development.

Just as we found we could live with $14 crudes by reducing operating costs in western Canada, I think we will develop and refine technology that will also allow us to develop the frontiers at anticipated crude prices.

DOUG STONEMAN:

Our panel of experts has been very helpful in outlining the "Frontier Potential". Roger talked about the state of exploration. He also told us about the change among explorationists away from the divine right to be able to spend as much money as they could wrap their arms around, to having to justify funding and profitability.

Richard was courageous in presenting his forecast. He told us to be realistic in our outlooks, but by any measure the potential in Canada's frontiers is certainly large. His slide that showed the frontier potential, compared to the tantalizing oil sands and our position in the world context, should by no means diminish the challenge of "Bringing it to Market".

Gary has talked about how the challenge of getting the technology to bring it to market is being met. When Gary told us his anecdote about the optimists, I thought he was going to give us the line that the optimist in 1986 was the geologist who brought his lunch to work. But nevertheless, we have to get out the big stick and go for the hole-in-one.

SESSION III

ECONOMICS, SUPPLY AND DEMAND

DOUG STONEMAN:

Good afternoon. Welcome to Session III: "Economics, Supply and Demand".

In this session we have two speakers: Chris Johnston and George Watson. Following their talks we will have time for questions and then coffee.

First to speak is Chris Johnston. Chris is Marketing Manager for Esso Resources Canada. He is responsible for marketing their Mackenzie Delta Gas. Chris joined Esso Resources in 1975, and has held a number of positions related to oil and gas facilities operations, production and facilities engineering and gas marketing. He holds a Bachelor of Applied Science and Chemical Engineering degree and he is a member of the Association of Professional Engineers, Geologists and Geophysicists of Alberta.

Please join me in welcoming Chris Johnston.

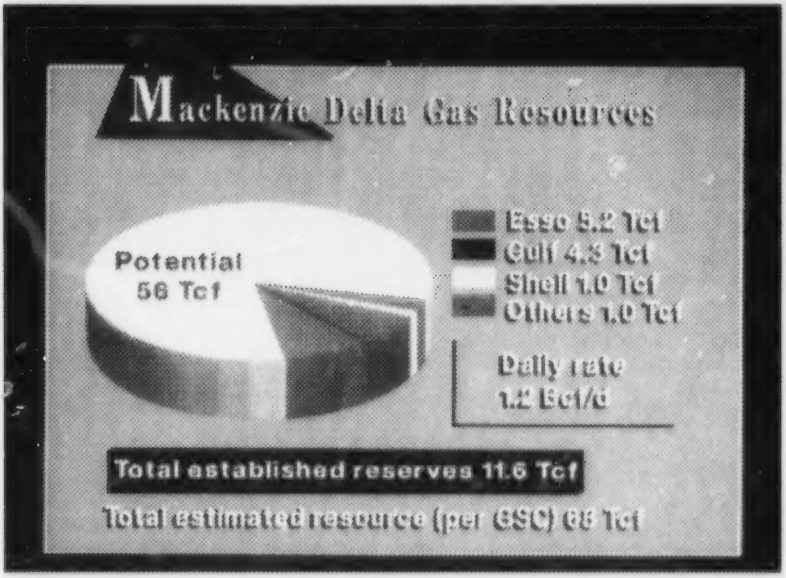
CHRIS JOHNSTON
Esso Resources Canada Limited

MARKETING FRONTIER GAS

The Mackenzie Delta Gas Project is market-driven. In my talk today I hope to give you a better idea of what exactly is meant by market-driven.

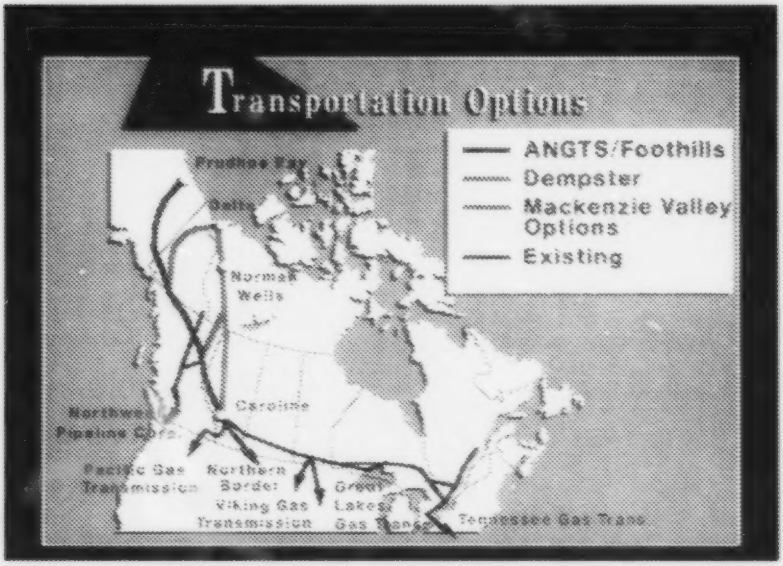
A market-driven project means that markets will determine what is done on a project and when it's going to be done. In order to give you a better understanding of this process, I will describe the Mackenzie Delta Gas project and show how markets will affect it. The key point is that Delta Gas can provide a large, competitive, long-term and secure gas supply. The major word in terms of the market is "competitive". The gas has to be competitive in a North American market in order to come on stream.

The pie graph shows the gas resources in the Mackenzie Delta. Established reserves are about 11.6 trillion cubic feet, which are sufficient for development. These reserves are continually being supplemented as exploration programs, discoveries and reserves additions continue to grow. The established reserves are broken down by company as shown on the right hand side: Esso at 5.2 trillion, Gulf at 4.3 trillion, Shell at about 1 trillion, and another trillion divided among various players throughout the north.



The potential in the area is very large. The Geological Survey of Canada has estimated its potential at 68 trillion, which includes the 11.6 trillion already discovered. In our opinion, the reserves are not a major problem on this project. There are sufficient reserves.

This graph shows the major transportation options, and that is what they are right now: options. Basically there are two. First, there is the Dempster Pipeline which ties into the Alaska system. Second, there are two Mackenzie Valley route options. All three of these options have had pipeline applications filed at the National Energy Board, although they are incomplete, and acknowledged as incomplete, applications.

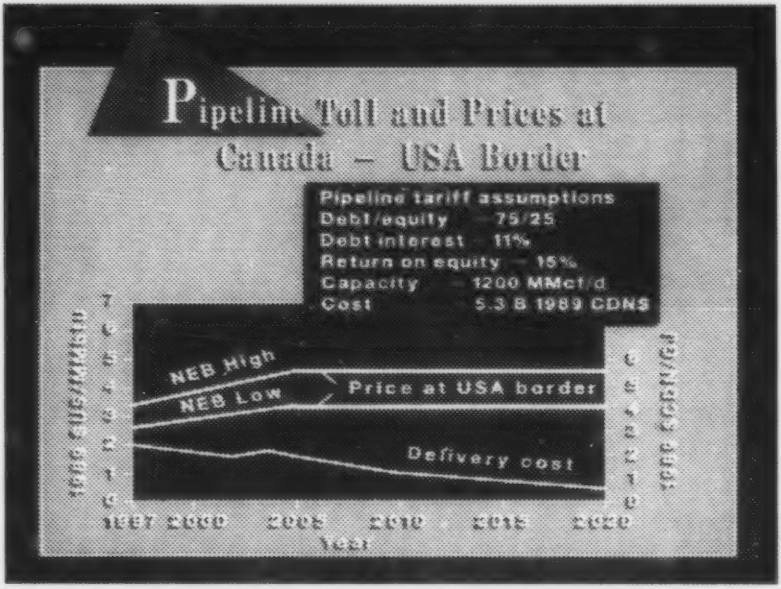


We are concerned that competitive pipelines, and proposals for pipelines that are competing, will probably stress unduly fragile relationships among northern groups, pipeline companies, producers and governments. Competitive pipelines will also create confusion in the market-place and scare off buyers.

For these reasons and others, the three producers—Esso, Shell and Gulf—and the three pipeline companies—Foothills, Polar Gas and Interprovincial Pipelines—are attempting to form a joint venture. The joint venture could then seek a certificate from the NEB to transport Mackenzie Delta Gas to southern markets. As you can see from the maps, once the pipeline reaches Caroline there is access to all North American markets through the existing system. At this time, the joint venture is not intended to sort out equity ownership. The purpose is to get a certificate from the NEB, to work through the regulatory process.

You might ask why we are doing it this way. Well, we recognize that pipeline costs are critical to the success of this project. Some 85 per cent of the initial cost of this project is in the pipeline. And, as I mentioned, cost-competition is a key factor. This graph gives you one method of looking at the economics of the project. It is a simple comparison of price forecasts against pipeline tolls or costs to deliver gas to the Canada/US border.

The box on the right-hand side shows the assumptions for a pipeline toll, which results in the yellow line representing costs of a toll for a pipeline down the Mackenzie Valley, and then from Caroline to two export points.



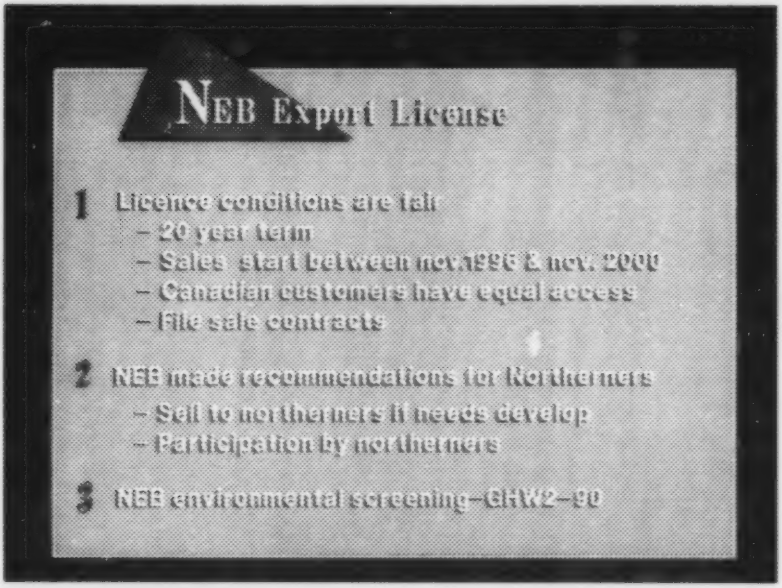
The two price forecasts are based on an NEB 1988 supply/demand study, which corresponds to about $20-30 US crude prices. The NEB forecasts carry their prices out to 2005; we held these flat thereafter. This type of chart is designed to demonstrate project viability and feasibility. It is not designed to say that these will be the economics or the prices or the costs. Those issues will be sorted out in the market.

The toll in the first year or the price to deliver it to the Canada/US border is about $2.00 per thousand cubic feet. That is about the average price today at the Canada/US border putting in long-term/short-term gas. It is obvious that we need price growth, cost reductions, toll-levelling methodology or all of these in order to make this project proceed. This is the challenge to sort out over the next few years as we continue trying to make this project work.

Another way of looking at project economics, and it is a rather simple way, is to divide the toll capital costs by the reserves in the project. If we do this, we end up with about $4.80 US per barrel of oil equivalent on gas reserves. That number does not seem very high by international standards.

These assumptions were the basis for our decision to proceed with the Mackenzie Delta project. We felt that this had to be a market-driven project. Therefore, we had to make sure that we had access to the market. That meant getting an export licence. Most of you here will recall that in October 1989 the

NEB gave us a positive decision, giving an export licence to each of the three companies for a total volume of 9.2 trillion cubic feet over a 20 year term, provided gas sales begin between November 1996 and November 2000.


NEB Export License
1 Licence conditions are tai
– 20 year term
– Sales start between nov.1996 & nov. 2000
– Canadian customers have equal access
– File sale contracts
2 NEB made recommendations for Northerners
– Sell to northerners if needs develop
– Participation by northerners
3 NEB environmental screening–GHW2–20

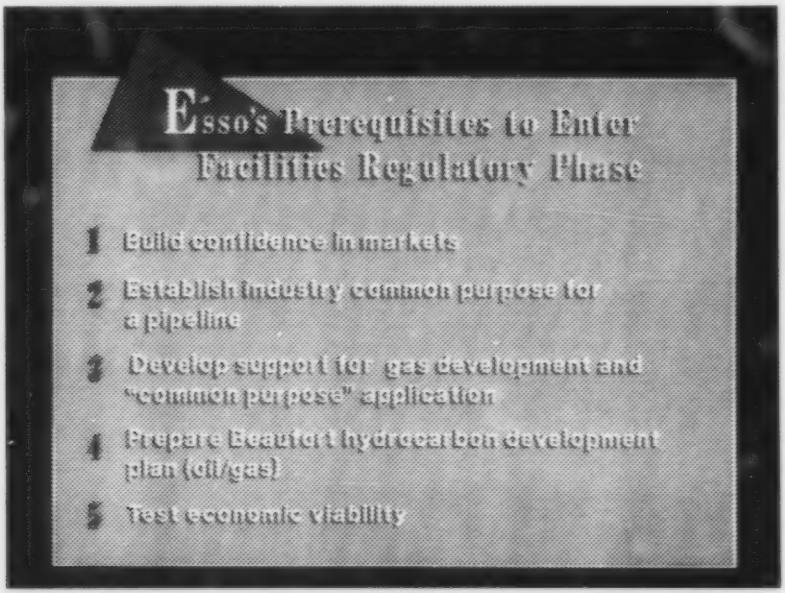
The NEB also imposed a condition that Canadian customers are to have equal, but not preferential, access to the gas. We view the domestic market as another market for this gas. It is potentially a viable market and we are more than willing to sell to domestic customers, provided they are willing to step forward and contract for the gas. There is every indication that this may come about. But the reserves are too large for just the domestic market. We need access to the export market. These reserves amount to about 2.5 per cent of the North American market, but more than 25 per cent of the Canadian market. In order to justify the facilities we have to operate them at full capacity for a long period of time.

The NEB made another condition that we file our sales contracts when we conclude them. At that point, domestic customers will have an opportunity to invoke the complaints procedure under NEB procedures. This procedure allows domestic customers who have not been able to buy gas under similar terms and conditions as export customers, to come forward and complain to the NEB. We do not anticipate that this condition will be a problem because we are offering domestic buyers equal opportunities to purchase the gas.

In addition, the NEB made recommendations to consider the northern concerns and northern issues voiced at the hearing. One concern was the sale of gas to northerners, if the need develops. It is a very small market, but northerners want to have access to these resources. Also, the NEB recommended participation by northerners in the decision-making process related to jobs, employment, business opportunities and the regulatory process.

Subsequent to the decision by the NEB, the issue of environmental screening came up. As you are all aware, the issue of export licences in the Mackenzie Delta and other areas are just now going through the process of environmental screening. The major issue here is: What is appropriate environmental screening for an export licence? I don't think any of us knows, but we are going to make submissions and see what happens. Jake Epp alluded to some of that this morning when he said there had to be greater predictability and he was uncertain of this environmental issue. It is something that we will have to deal with.

So then the question comes: What do we do next? We have our export licence. What is the next step in the process? We are approaching this one step at a time. We are not following the traditional approach of getting a big project team together, then trying to do the whole project at once. This next graph shows the factors in which we have to increase our confidence before we make the decision to proceed to the regulatory phase for facilities. Basically, we need to increase our confidence in the project's viability.


Esso's Prerequisites to Enter Facilities Regulatory Phase
1 Build confidence in markets
2 Establish industry common purpose for a pipeline
3 Develop support for gas development and "common purpose" application
4 Prepare Beaufort hydrocarbon development plan (oil/gas)
5 Test economic viability

First, we must build greater confidence in the markets. Will there be ample demand for the gas? Will the price be sufficient? Will there be the risk-sharing mechanisms among buyers, sellers, pipeline companies and governments to allow the project to proceed? We must assess these issues.

Second, we must establish what we have called industry common purpose to build a pipeline. This is the joint venture I noted earlier. It is not a reality yet, but we are continuing to work at it. It will take some time, but the rewards will be quite significant.

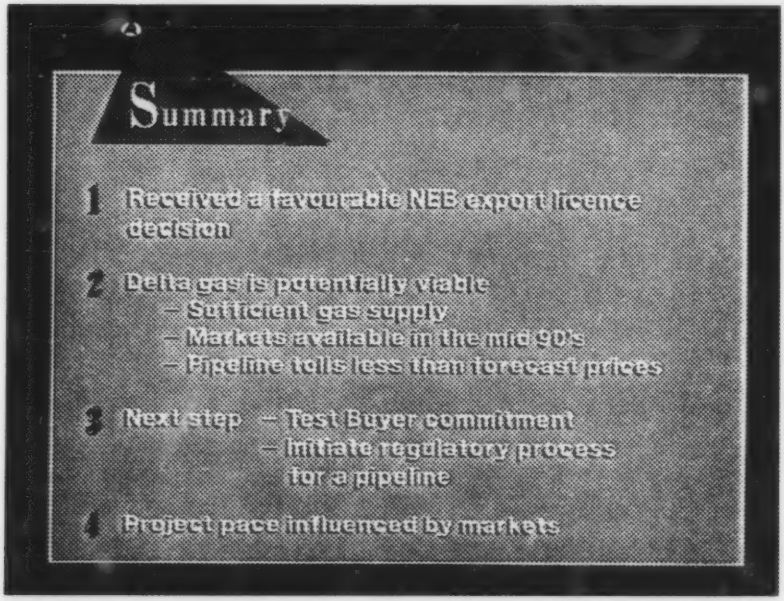
Third, and a very important part of the process, we must get critical public support for the project. Delta Gas will require a multitude of regulatory

approvals and licences, entailing a high level of public scrutiny and input. To make it through the public arena we need the support of various public groups. Getting that support will require consultation, participation, and addressing the legitimate issues of public groups.

The producers are now working together to produce a Beaufort Hydrocarbon Development Plan, which will consider the impact of oil development on gas and of gas development on oil. There are significant opportunities to reduce costs if we use a managed and co-ordinated approach. And on this issue we will have to get all the regulatory approvals. We cannot go forward and get regulatory approval on gas without dealing with oil issues, nor can we get regulatory approval on oil without dealing with gas issues.

After going through all these processes, and once we have built up our confidence, we must test the economics again. Does the project still look economically viable, before we spend millions of dollars to advance through the regulatory phase? It is our hope that we can accomplish four or five steps over the next year. Although this may not be possible, we would not shut the project down. We would simply continue to try and build up this confidence. Our plans would simply take longer.

In summary, we have received our export licence decisions from the NEB, but Cabinet has yet to approve them. Cabinet, of course, is waiting for the environmental screening to be done. Delta Gas is potentially viable—in our minds there is a sufficient gas supply already established. Forecasts of markets indicate there will be a need for this gas in the 1996-1998 time period. The pipeline tolls to deliver the gas also make the project potentially viable.


Summary
1 Received a favourable NEB export licence decision
2 Delta gas is potentially viable
– Sufficient gas supply
– Markets available in the mid 90's
– Pipeline tolls less than forecast prices
3 Next step – Test Buyer commitment
– Initiate regulatory process for a pipeline
4 Project pace influenced by markets

In practice, we are marching one step at a time. The project is a challenge for project management. In a period of uncertain prices in uncertain markets, you must find a way to advance the project.

Our approach of proceeding by stages is non-traditional. In a traditional approach, you determine the best economic time to start up the project and then you decide what has to be done today to meet that schedule. This is not what we are doing on this project. We are trying to manage the issues and let the schedule be a fallout of the management of the issues.

The project pace is going to be influenced by markets. The challenge is to know when the markets are ready and to be ready when the markets need the gas. We are trying, therefore, to measure the markets and get ourselves ready.

Another barrier to frontier projects is to take an 8-9 year project and shrink it down to a 3-4 year project. People tend to view longer-term projects as 8-10 years away, so they have difficulty getting interested in them. So we need to find a way of making them into a short-term project so we will get people's attention. Only then can we make decisions.

Our non-traditional approach is our answer to that challenge. We are involved with finding low-cost activities we can do today to advance the project. We want to lay the groundwork before we move on to building big-ticket facilities.

DOUG STONEMAN:

Thank you, Chris.

Our next speaker is George Watson. Mr. Watson is going to talk about "The Decision to Produce." George will give us a view from the financial side of financing and financibility—the critical element in all of this activity.

George joined the Canadian Imperial Bank of Commerce and spent seven years in project financing. During that time he was involved with many mega-projects in connection with the oil and gas industry. In 1981, he became the Vice-President of Finance for Dome Petroleum. From 1988 to the present, George has been President and Chief Executive Officer of Intensity Resources Ltd.

Please join me in welcoming George Watson.

GEORGE WATSON
President and Chief Executive Officer
Intensity Resources Ltd.

THE DECISION TO PRODUCE

I would like to say thank you for inviting me here. It helped to scrape off the barnacles. I run my own small oil company. Having to consider financial problems once again gives me an opportunity to re-think things. Most of the speakers here have opened with a joke. But financial types, and I am obviously a financial type, are noted for their lack of humour. Therefore, there is no joke.

I would like to talk to you about mega-projects—the decision to develop. There are really three main topics that I would like to dwell on. First, the decision to develop is really a process that we must recognize. If you are in management, you may realize that the decision to develop is a process that is sometimes harder to reverse than it is to start. I will deal with this as I go along. Second, I will touch on the topic of project finance, which you might be interested in. And finally, I will wrap it up with the elements of making that final, critical decision.

ELEMENTS OF THE PROCESS:

There are really four main elements of the process. The first is identification of project sponsors. The second element is assessment of risk. Risk assessment is very important and you must be honest. The third is an assessment of rewards. The fourth and last element is equitable sponsor-sharing of risk and reward.

PROJECT SPONSORS:

Who are they? To this group, this is probably the easiest thing to identify because the projects you are working on have identifiable sponsors such as reserve owners, governments, suppliers, and users. Other speakers have talked about project sponsors here today.

ASSESSMENT OF RISKS:

The assessment of risks is important to the decision-making process because without an honest assessment you can make some awful mistakes. There are technical and transportation risks, unpredictable, variable markets and prices and political and environmental issues. From the technical side, I heard a lot of comfortable things from Gary today. We have proved technology, which we can use or adapt for these mega-projects. As a financier I feel very warm and comfortable with the old and proved technology—no risks there at all.

On the reserves side, we had agreement on the level of reserves. I am warm and comfortable as a financial guy that we understand exactly what we have here. On the question of capital cost over-runs—I felt warm and

comfortable too. With proved technology you know what your operating costs are going to be.

Technical risk is a very difficult thing to get your hands on, but it is very important to the final decision.

TRANSPORTATION:

Transportation is probably less risky with a few of the advancements in transportation in terms of pipelines. But when you get into things like ice-breaking tankers, it is just another risk factor.

MARKETS:

You have to get a handle on your markets. As Chris mentioned, projects today are far more market-driven. If they are market-driven, the issues include these: Are markets assured? Are they contracted? Are they free from governmental intervention? What is the length of commitment? Are there alternate supplies that could come in and intervene and cause you—by governmental or regulatory fiat—to be knocked out of the market? What kind of volume obligations do you have? These risks need to be assessed. You do not have to have every one of these questions nailed down, but you have to have a good appreciation of what you have got.

PRICE:

Fixed price? Floating price? What is your transportation risk? What is the cost of the service demand charge? What are the escalation provisions in price? These are important for your assessment of a rate of return.

POLITICAL:

The political climate has improved quite a bit from the way it used to be. You need to understand what your royalty regime is. You need to understand the potential for any change of priorities. In my opinion, this is a major political risk. We are dealing primarily with long-term projects, with most of them lasting 20 years. What are the chances that priorities will change and affect your project? What is the length of export and import approvals?

ENVIRONMENTAL:

This is a biggie. It is a growing market that you will not fully perceive until insurance becomes available for your protection. It will be interesting to see how the insurance people react. There always will be a large element of self-insurance, but beyond that, for the bigger mistakes, there will be the question of the degree to which you can use insurance to help you cover the disaster risks.

CAPITAL MARKETS:

As Jake Epp said earlier, get out and talk to people about your environmental concerns. The same applies to the capital markets. Capital markets are just people. There is a great deal of capital available, and your projects may well depend on how well you can communicate that you have the risks covered and that the environmental risks are lower than many people think. There has not been any significant capital raised on any projects since the Exxon Valdez and a few other recent disasters.

ASSESSMENT OF REWARD:

It is important that each sponsor take a good look at the expected return from a project. In order to do this, you have to have a pretty good handle on your risks. Useful here is a scenario analysis, which, I am sure, most of you are familiar with. In the most likely case, what are your down-side risks and your expected returns? These calculations have to be made from each sponsor's perspective. I suggest you do it from your own perspective as an individual sponsor, and also from the perspective of the other guy.

You have to determine who is getting away with the better deal. This is also part of the decision at the end of the process. "Equitable Sponsor-Sharing of Risk and Reward" seem like fine words, but you would be surprised how many deals do not go ahead because Jerry feels that Paul is getting a better deal. It is very important that those who reap the returns also share their proportionate share of the risk.

PROJECT FINANCE:

Project finance is defined as a method of financing based totally on the characteristics and economics of the project, i.e., pure project finance is where the lender puts up the money, but has no recourse at all to the sponsors' capital. This is very rare. More likely is an impure form of project finance where the same structure exists, but there are equity investment agreements that allow negotiated access to the sponsors' credit.

The advantages of using the impure form of project finance are the access to sponsor credits with completion undertakings, the purchase of through-put toll agreements (agreements in which sponsors designate how much they are going to put through each time), raw material supply agreements and cash deficiency agreements to manage things according to equity support agreements.

Another advantage for the sponsor is that the debt incurred is largely off the balance sheet. It is not actually shown on the books. You do not have any risk for it. All you have is the risk to put up money as you go along. The main advantage of this approach for very complex mega-projects is my next point.

NEGOTIATED ACCESS TO SPONSOR RESOURCES:

As you are putting together a project, each sponsor puts up in relation to his interest. Hibernia, for example, is following this process, but it can take many different forms (lenders, no lenders, etc.).

THE DISADVANTAGES OF PROJECT FINANCE:

This is very complex, time-consuming and costly. When you borrow money, it costs you more because, for taking risks, the lender wants more. You limit your sources of capital. Public markets do not understand project finance. If you want to do project finance you go to bankers. The bankers see you coming. They understand you, but they also charge you for that understanding.

Bankers love project financing because they get a good fee and a good interest rate. You always renegotiate them because the terms are short, prompting another fee and another rate increase. It costs more to go that route, but sometimes it is the only way in which you can get a deal completed, if the sponsors themselves cannot get together. Foothills Pipelines and Northern Border are an example of having recourse to the banks and then getting out, I think, it is now longer-term public debt.

MAKING THE FINAL DECISION:

If you have been involved in a project from a financial or a senior financial position, you find that the process goes on for a few years and you get co-opted by it. But there comes a day, the judgment day shall we say, when it is easier to go ahead than it is to turn back. It comes down to a very hard look at the risk versus reward. This risk-versus-reward profile can change over time. The premise on which you started may not be the premise on which you finished. The deck chairs may have moved. It may not be wise to go ahead. This is a very difficult position to be in.

The financing plan is usually the last thing put together. It has to be acceptable to all the sponsors. If the economics and the other elements are there, the financing plan can usually be accomplished. The financing plan is not usually a major drawback, then, unless there is a collapse in the capital market.

EXPECTED RETURN:

The expected return can also vary during this process. Projects that looked good in 1985 did not necessarily look good in 1986. These things can happen, and they are much easier to justify stopping or continuing a project.

EQUITABLE SPONSOR RISK SHARING:

Equitable sponsor risk sharing is where all the guys at the top of all the companies look to see who got what. What did I get? What can I expect to get as opposed to what the other guy will get. There has to be some agreed equity among risk sharers or the deal could come screeching to a halt.

AFFORDABILITY OF THE DOWNSIDE CASE:

When you are in a senior financial position at a big company, it is fine to look at the high and the expected. But what you want to do is look at the downside case and say, "Okay. If this is really what happens here, what will to happen to us? Have we taken too big a piece? Have we taken too small a piece?"

The affordability of the downside case is something every company must consider. Companies will pull out or take smaller pieces if they cannot afford the downside. Each decision to proceed on a major project is unique to each sponsor. The criteria for Jerry's decision to go ahead may be very different from Paul's.

SESSION III DISCUSSION PERIOD

QUESTION:

Chris Johnston, what is your definition of public support?

CHRIS JOHNSTON:

I think public support is a subjective matter that each group, or party in a consortium, and each one of the sponsoring companies will need to assess. Whether or not they have it would be based on various meetings they have with public groups, what type of feedback they get from these meetings and the type of public posturing the public groups are doing. These kinds of indicators will give a signal on whether or not there is support for your project.

QUESTION:

Does that mean a major review process?

CHRIS JOHNSTON:

Yes, it does. The public to me means consumers, environmental groups and the northern groups who will be most affected by the project. It affects a large group of people.

QUESTION:

Would it include the public utilities commissions?

CHRIS JOHNSTON:

Yes, I consider utilities as part of the consuming areas.

DOUG STONEMAN:

I guess it means everyone, all the affected parties.

CHRIS JOHNSTON:

Yes, and perhaps I can add one item. As part of the marketing, I consider that state or provincial public utilities boards have a major impact. It is very important that you understand their policies and principles, and how they could apply to the project.

QUESTION:

I'd like to ask Chris Johnston whether he is hoping the NEB will depart from any of its environmental constraints. I also [inaudible] you have to have an absolute liability as an operator of roughly $40 million. Some producers think that is far too low and have suggested liabilities in the range of perhaps hundreds of millions of dollars. [inaudible]

CHRIS JOHNSTON:

With regard to the environmental screening, I am not sure of all the rules and regulations throughout the Inuvialuit environmental screening process. What we are doing now is having an environmental screening of an export licence. We are not presenting any facilities applications or details related to facilities. If we were, then my understanding is that the Inuvialuit would have the opportunity to have an environmental screening. In other words, their environmental screening pertains more to the aspect of the physical facilities than to the issue of export licences.

GEORGE WATSON:

On the question of insurance, I believe that the $40 million is not the limit under COGLA. I believe you are absolutely liable but, I think, the $40 million is bonding. We used to bond with bankers' letters of credit, and then we would go higher than that. We actually were up around $300 million with pollution and environmental insurance for blow-out prevention. It was hæmorrhage coverage, but in the days of Dome's financial demise, its credit was shaky and we could not afford to take that kind of risk. But it is available for pollution coverage, blow-outs, and so on.

The interesting challenge occurs where some of these things could get over a billion dollars or more if there were a really bad one on the offshore with facilities and everything else. The challenge for the insurance market is we could get $300 million, but I am not sure how much more we could get.

DOUG STONEMAN:

A few questions were passed to me to ask our panelists.

One is a very general question for Chris. The Minister this morning talked about how things have changed and how there is a move for development in many of our frontiers and particularly in the Delta. What has changed since the 1970s when Delta gas was last being pursued?

CHRIS JOHNSTON:

Well, I support what Mr. Epp was saying this morning. The Northern Accord as it relates to the people's attitudes has definitely changed the north. Back in the 1970s, there was a lot of apprehension and pessimism about the project. Today, people are anxious to get on with development. Northern groups see how they can participate in development with land claims and the Northern Accord.

But the other change, and perhaps a more substantive one, is economic. There have been cost reductions on the Mackenzie Delta Gas Project since the 1970s. Some of these reductions were discussed this morning in terms of applying new technology or using the same technology, but in a different way.

Also, there are now additional reserves. In the 1970s, if you can remember, there was not a Mackenzie Delta Gas "stand alone" project. Mackenzie Delta Gas was tied in with Alaska Gas. Now we believe there are sufficient reserves to allow us to have a "stand alone" Mackenzie Delta Gas Project.

Further, our approach is quiet different now. We are being governed more by markets. In the 1970s, it was a matter of the facilities development leading the projects rather than the markets leading.

QUESTION:

Mr. Watson, please elaborate further on what's called equitable sponsor risk sharing.

GEORGE WATSON:

It means that every sponsor is happy with what everybody else is putting in and with what everybody else is taking out. Equitable sponsor risk sharing is in the eye of the beholder. Everyone sitting around the table must think that a fair deal has been cut. This involves the project sponsors, the governments, reserves owners, the transportation companies, and so on. It is unique to each project and perceived individually by each sponsor.

DOUG STONEMAN:

Chris, you mentioned risk-sharing, and I think you mentioned buyers and sellers. How do you see this being handled on a major project like the Delta? Through contracts or some other way?

CHRIS JOHNSTON:

I see the risk-sharing mechanism being handled through contracts. However, the contracts are going to need regulatory approval from both Canada and the US. The public utilities boards/public utilities commissions in the US and Canada have a great role to play. I need to be sure that their policies will allow the privately negotiated arrangements between the buyers and the sellers to remain.

DOUG STONEMAN:

Do you have any thoughts as to the nature of the contracts that will require long-term underpinning and presumably some flexibility for short-term circumstances?

CHRIS JOHNSTON:

There have to be long-term contracts with assurances of take. There will have to be payments of demand charges, and conditions such as those in the contract itself. There will have to be a negotiated settlement between the buyers, Canadian or American, and the producers.

DOUG STONEMAN:

What you are both saying is that there have to be some very different arrangements than what we have been accustomed to in the past.

CHRIS JOHNSTON:

Yes, I would agree with that.

DOUG STONEMAN:

George, you talked about project financing. Perhaps you can give us a couple of examples of successful and unsuccessful project financing endeavours.

GEORGE WATSON:

Let us start with the good examples first. I was involved with the first phase of the Alaskan highway transportation system, the Foothills PreBuild, and it worked really well. Even though I was on the financing side, we had a concern about throughput—and rightly so, as it turned out. When I did the financing on the Canadian side we matched the base tariff, which equalled an 18 per cent throughput.

Everybody thought that it was going to be 95 per cent throughput all the time, by assuming that the demand tariff would be so much higher than the revenues coming in that the Alberta system would be subsidizing gas going south. That is the kind of certainty and uncertainty that you have to build into these things.

That project worked and is now going full-out. One that did not work—from a lender's point of view—was the Quintette Coal Mine. It worked from a sponsor's point of view, of course. The sponsor—Denison—paid up its share, wrote off its equity interest and left the mine with the banks. This is a case where the Japanese had large sources of coal. When there was an oversupply in the market and demand dropped and prices kept going down, the banks got trapped.

Another one that did not work for a similar reason was Western LNG. It failed because it never got the go-ahead, which is fortunate because it would have been an awful mistake to have gone ahead with the Western LNG project. Anyone who was looking at the worldwide perspective—I am sorry to any of the ex-Dome proponents who may be here today—saw that there were other places a lot cheaper than western LNG.

These are two examples. One absolutely failed and cost people money. The other did not go ahead because it was a bad project.

DOUG STONEMAN:

Thank you. I think it was Yogi Berra that said we don't want to make the wrong mistake.

QUESTION:

You mentioned several times the reserve holders, and then said right afterwards "and the government." What is industry's definition of a reserve holder? I thought it was the government.

GEORGE WATSON:

Okay, you got me there. We could call it the reserves sponsor or the reserves owner.

DOUG STONEMAN:

I think we acknowledge that the Crown has a right to a royalty.

GEORGE WATSON:

Yes, that is correct.

QUESTION:

Is it important to have an export licence?

GEORGE WATSON:

Well, in my visits to the US I have found that interest has picked up among US buyers. The export licence does assist in the marketing efforts, and that is one reason to apply for an export licence. You definitely get the interest of buyers in the US if you have an export licence. I would not say that they are ready to sign any contracts for Mackenzie Delta Gas, but neither are we ready to sign. At least there are more people willing to talk about the viability of Delta gas.

QUESTION:

George, you mentioned equitable sharing of risk or reward. Will there ever be any capital markets that will actually share any project risk? In other words, will there truly be a recourse to project finance?

GEORGE WATSON:

You would not want to pay the cost.

SUMMARY AND CONCLUSION SESSIONS II AND III

DOUG STONEMAN:

I believe it was Doug Baldwin, in his keynote address, who mentioned seven factors in "Bringing it to Market." In our two sessions we have talked about potential, we have talked about technology and we have touched on the regulatory framework (which will be addressed more fully later). We have talked about markets and we have talked about economics and financing. So I think that we have worked our way along the list quite well.

The presentations have provided some refreshers for us all. The stark differences in the business as we see it today and as we look ahead contrast sharply to 10-20 years ago. One fundamental change is that we are looking at market-driven policies versus ones based on administration and made in Canada prices. Perhaps the challenge for us is to be able to bring it to market and to compete in the global arena.

Richard Dingwall provided some views comparing Canada's potential to the world's potential. But in the discussion that ensued, it was rather startling to comprehend that, as we enter the next century, Canada will be depending on its frontiers for its oil and gas, where, in the past, it has depended on western Canada. And, of course, the oil sands are now out there as well. This says to me that we are looking at some very different businesses as we look ahead over the next 10 and 20 years.

It is very clear to me that the potential is there and we will pace our investments to match the market. I firmly believe, as Doug Baldwin said, that the market will be there both in the domestic and the export components and that we can be competitive in order to serve that market.

Ladies and gentlemen, please join me in thanking our panelists for a lively and interesting session.

SESSION IV

REGULATORY ENVIRONMENT

INTRODUCTION:

AL LYMER,
Amoco

Good afternoon, ladies and gentlemen, and welcome back to this afternoon's session—the tough one. The title of this session is "The Regulatory Environment".

My name is Al Lymer. I am going to act as chairman and moderator for this session. My colleagues have asked me, because I am an Oiler fan, not to tell any more Calgary Flames jokes. And I won't. This reminds me, however, of a question Phil Airhart posed the other day.

"Do you know what is forty feet long, three feet wide and sleeps twenty?", he asked. I said, "No, Phil, I honestly don't." He said, "The Calgary Flame's bench."

The workshop has arranged five qualified people to speak about the regulatory environment: Glenn Yungblut (COGLA), Graham Nichols (GNWT), Fred Weir (CNSOPB), John Fitzgerald (CNSOPB) and Terry Sewell (GYT). They all hold key positions in the oil and gas sector within their regions. The format we will follow is similar to the format used by the two groups chaired earlier by Doug Stoneman.

As this session is the last for the day, this analogy can be made: speakers are like gamblers. They must know enough to quit when they are ahead.

Because this session is going to be in English, Mo Taschereau said that he will run a commentary in French. He sits near the back, so sit near him if you wish that service.

Glenn Yungblut is director of the General Engineering Branch of the Canada Oil and Gas Lands Administration. Glenn graduated from Queen's University in 1954 with a Bachelor of Science in mechanical engineering. He worked for Shell Canada until 1970, at that time serving as Offshore Drilling Superintendent on both the west and east coasts of Canada. He joined the federal Department of Energy, Mines and Resources as Chief Engineer in the Resources Management Branch—the predecessor of COGLA.

He left the public service in 1981 to become a partner in EPI Resources, a company that provided engineering consulting services to frontier operators. In 1988, he returned to the public service in his present position.

Please help me welcome Glenn Yungblut.

MR. GLENN YUNGBLUT,
Director, General Engineering Branch
Canada Oil and Gas Lands Administration

COGLA'S REGULATORY RESPONSIBILITIES AND REGIME

I would like to give you a stripped down, sanitized version of the Canada Oil and Gas Lands Administration (COGLA), its mandate, the legislative authority under which it operates and the procedures it follows. This version will be free of all the complications that exist in the real world. In essence, it assumes that EARP, NEB, Inuvialuit Final Agreement, Land Use Committee, and some unnamed departments do not exist.

COGLA was established in 1981 by a memorandum of understanding between the minister of Energy, Mines and Resources and the minister of Indian and Northern Affairs. It replaced the Resource Management Branch of EMR and the Northern Non-Renewable Resources Branch of DIAND. Up to that time, those branches were responsible for oil and gas matters on Canada Lands. Canada Lands included all offshore areas on both the east and the west coasts, the Arctic, Yukon Territory and the Northwest Territories.

Since then, the federal, Newfoundland and Nova Scotia governments have signed agreements assigning regulatory responsibilities to offshore petroleum boards.

At present, COGLA is responsible for the Arctic Offshore, Hudson Bay, the West Coast, the Yukon Territory and the Northwest Territories. Existing agreements-in-principle, however, will eventually turn over the regulatory responsibility to organizations in their regions, that are likely to be similar to those we have now in Nova Scotia and Newfoundland.

COGLA has two main responsibilities. The first is to manage the oil and natural gas resources that underlie Canada Lands. The second is to regulate oil and gas activities carried out in exploration, development and production.

Managing the resources on behalf of the Canadian public involves acting as the property manager of the oil and gas resources on lands that are the direct responsibility of the federal government. In performing this function, COGLA evaluates the potential of each geological basin. It also arranges land sales whereby companies can acquire the right to explore for oil and gas, and the right to produce what they find.

COGLA collects the royalty on the resource as it is produced. In this respect, COGLA is responsible for ensuring that the resources are explored and developed in an appropriate time frame, and that the terms and conditions allow the government and the public to receive the best overall return from the resource. The return from the resource is not simply royalties. It also includes employment, creation of new skills, development of infrastructure in remote areas, meeting the security of supply needs and other associated benefits.

Oil and gas activities are regulated to ensure that the work is carried out in such a way that the workers are safe, that there is no pollution, and that resources are not wasted through poor production practices. We do this through a system of approvals based on a careful assessment of a proposed project against the standards and requirements set out in regulations and guidelines.

In addition, during the life of a project the facilities and operations are regularly inspected to ensure that the equipment is being maintained and proper procedures are being followed.

COGLA administers three pieces of legislation:

- The Canada Petroleum Resources Act
- The Canada Labour Code
- The Oil and Gas Production and Conservation Act

The Canada Petroleum Resources Act The Canada Petroleum Resources Act (CPRA) provides for granting the right to search for, develop and produce petroleum resources. The main features consist of:

- The process for granting rights and interests
- Establishing "exploration licences"
- Establishing "significant discovery licences"
- Requiring at least 50 per cent Canadian ownership in the development of a field
- Authority to set and collect royalties
- Establishing the environmental studies research fund
- Establishing processes for transfers, assignments and registration of interests
- Providing for enforcement

The Canada Labour Code In 1984 the Canada Labour Code (Part II) was extended so that it applied to the exploration and development of petroleum on lands subject to federal jurisdiction.

COGLA was given responsibility for enforcement through a 1987 memorandum of understanding with Labour Canada.

The Code's principle objective is to ensure a safe work place. Its main features consist of:

- Authority to make and enforce regulations
- Establishing an employee's right to know if a danger exists
- Establishing an employee's right to participate in matters involving safety
- Establishing an employee's right to refuse dangerous work
- Establishing the specific duties of the employee and employer regarding safety matters
- Creating "Safety Officers" and "Regional Safety Officers"

There are two main sets of regulations under the Code that affect us. The Oil and Gas Occupational Safety and Health Regulations (OSHA) deal primarily with:

- Specifying the equipment and material that can or should be used
- Requiring and specifying how workers are to be given information on hazardous material
- Making sure that accidents and dangerous situations are reported, responded to and investigated
- Requiring that safety procedures are in place
- Requiring that workers be properly trained and informed about potential dangers

The other set of regulations—the safety and health committee and representatives regulations—establishes the requirement for a committee and stipulates its make-up.

The Oil and Gas Production and Conservation Act The third piece of legislation is the Oil and Gas Production and Conservation Act. This Act was first promulgated in 1968. Since then, it has had minor amendments in 1981 and 1986, but the purpose and main features of the Act have not changed since 1968. The purpose of the Act is:

- To ensure safety of the workers
- To prevent pollution
- To prevent the waste of resources
- To ensure proper facilities are used
- To encourage the employment of Canadians

The Act:

- Provides for authority to make regulations
- Provides authority to regulate
- Establishes the requirement for an approved development plan
- Creates a Chief Conservation Officer to make decisions on safety, resource conservation matters and pollution prevention, and who

has the power to order activities to cease;

- Creates Conservation Engineers to enforce the Act and its regulations with power to order activities to cease if a safety regulation is being violated
- Provides for forced unitization
- Creates "absolute liability" in regard to spills and debris
- Provides for prosecution where an operator contravenes the regulations or certain other parts of the Act, and stipulates the maximum penalties
- Establishes Oil and Gas Committees to hear appeals, to hold inquiries and to make orders concerning resource conservation matters such as water flood schemes, pressure maintenance, etc.

As most of you know, we are currently preparing amendments to the Act. These amendments are largely in response to the recommendations of the Royal Commission on the Ocean Ranger and the other work that was done around that disaster. The main purpose of the amendments is to enhance the safety provisions of the Act. These will consist of:

- Establishing the requirement that owners and operators provide a declaration that equipment and facilities are fit for the purpose for which they are being used
- Establishing the requirement that operators obtain a Certificate of Fitness for certain facilities and installations from an approved Certifying Authority
- Creating a Chief Safety Officer and Safety Officers empowered to order activities to cease if there is risk to the worker
- Creating requirements for each offshore installation to have an Offshore Installation Manager who will have certain power—similar to those of a ship's captain—and who will be required to have certain qualifications
- Creating an Oil and Gas Administration Advisory Council to ensure consistency in the application of regulations amongst the various regulatory agencies
- Creating an Offshore Oil and Gas Training Standards Advisory Board to advise on the training requirements of offshore workers and on the adequacy of various training courses
- Establishing the requirement for an independent investigation of all serious accidents or oil spills

In addition to these amendments, consultations are being held about three other possible amendments.

The first amendment would establish the right of all interest holders to participate in the development of a field—thereby protecting their correlative rights. The second would establish the right for operators to have access to use any excess capacity that may exist in established facilities and installations on a fair and reasonable basis. The third would have the affect of making the decisions of the Oil and Gas Committee advisory.

It is our goal to have these amendments ready for the legislators this fall.

Regulations and Approvals At present, there have been four sets of regulations promulgated under the Oil and Gas Production and Conservation Act and six sets are in various stages of preparation. Three of the six are in the process of being reviewed by the Justice Section of the Privy Council Office (PCO-J) which is the final step in the regulation-making process. This turns out to be a mighty big step sometimes, but it is the final step nevertheless.The following, then, is a brief summary of these regulations and their status.

- The Drilling Regulations were first promulgated in 1979 with minor amendments in 1988. We are, at present, in the initial stages of doing a thorough updating of these regulations.
- The Diving Regulations were promulgated in 1988.
- The Operations Regulations were promulgated in 1983 and amended in 1987.
- The Spill and Debris Liability Regulations were promulgated in 1987.
- The Production and Conservation Regulations are currently with PCO-J and we expect they will be approved within the next two months. These have been reviewed by and discussed extensively with industry over the past four years.
- The geophysical regulations are currently with PCO-J and we expect they will be approved this year.
- The Certificate of Fitness Regulations are being translated and made ready from a technical standpoint to be submitted to PCO-J. Since these are a fairly short, non-technical set of regulations, we expect that they will be approved fairly quickly this fall.
- The Installations Regulations—which deal with the actual structures—are currently under a second review by industry. We hope we can reach sufficient consensus with the industry technical committee over the next few months so that the regulations can be submitted to PCO-J this September.
- The Offshore Pipeline Regulations have been drafted and have received the initial review by industry. Due to other priorities, however, they are currently on hold.
- Finally, the Onshore Pipeline Regulations are being drafted but, like the Onshore Regulations, are receiving low priority in our work load.

I would now like to briefly review the regulations to identify the special features of each set.

The Drilling Regulations feature two approvals:

- The Drilling Program Approval
- The Authority to Drill a Well

They contain a requirement:

- That equipment meets specified standards
- That the well design meets certain standards
- To test and inspect equipment periodically
- To have contingency plans
- To dispose of waste materials in an approved way
- To report to the Chief Conservation Officer
- To test and evaluate the well
- To take and keep samples
- To have trained personnel and regular drills
- To keep and submit records

The process for approving the drilling of a well involves a two steps. First, the operator must apply for an approval for his drilling program—called Drilling Program Approval; second, the operator must receive authority to drill a well.

The application for Drilling Program Approval must be submitted four months prior to the spud of the first well of the program and should provide details on the following:

- General information on the project including the geography, holders of interest in the exploration agreement, and the duration of program
- Details on the construction of the drilling base i.e., ice, berm or artificial islands, if applicable, including design, the construction plan, the source of material, monitoring and instrumentation, etc.
- Complete details on the drilling unit including:
    - plans, diagrams and specifications
    - drilling and marine operations manuals
    - results of pre-drilling site investigations
- Details on the support craft and systems including:
    - the standby and supply boats
    - the supply base
    - the aircraft support
    - the communications systems
- Details on the geology of the area and on the procedures to deal with potential problems or hazards such as:
    - devils formations, slumping formations
    - casing, cementation and logging programs that will be used to control the problems

- Description of the physical environment including:
    - climate and oceanographic data
    - the weather and ice forecasting arrangements
- A discussion of environmental concerns including:
    - impact on the environment of the region
    - the ability of the drilling unit to respond to extreme events
    - mud disposal particularly any containing oil
    - sewage and waste treatment
- And finally, complete contingency plans for all potential accidents or threats including:
    - oil spills, blowouts, collisions, drilling of relief wells and rescue at sea

Once the program is submitted, COGLA assesses and studies the application in consultation with experts in other departments and agencies. When we are satisfied that the drilling program provides the framework for a safe, environmentally sound drilling project, the Chief Conservation Officer approves the program.

The operator requires a second approval—"An Authority to Drill a Well"—before he can actually drill. The application for an Authority to Drill a Well should be submitted at least 21 days prior to spud of the well and should include:

- General information including a project summary, the participants, and a survey plan
- The specific well prognosis including:
    - the anticipated geological stratigraphy
    - drilling plan—including casing setting depths and sizes, and program, logging program, deviation control, etc.
- Specific relief well arrangement; specific environmental concerns at the location
- Any modifications to contingency plans for the specific location
- Proof of adequate financial resources and insurance

As with the Drilling Program application, this information is carefully reviewed by COGLA in consultation with other departments and agencies with particular attention to the well design and to the procedures that will be used to combat potential hazards. When we are satisfied that the drilling plan provides for a safe, pollution-free operation, a conservation engineer will approve the drilling of the well.

The actual drilling operations are inspected regularly to ensure that the regulations are being complied with and that the approved program and plans are being followed.

The Diving Regulations contain one specific approval, that is an actual approval for the diving program that will be followed in a project. This program describes the equipment and procedures that will be following in carrying out a dive. They also contain:

- The requirement to have equipment inspected
- The requirement for equipment to meet prescribed standards
- The requirement to have a doctor who is familiar with diving
- The requirement to have a diving safety specialist on call
- The requirement to use only trained divers, diving supervisors and other dive-related personnel
- The requirement to keep logs and records
- The requirement that diving crews and other dive-related personnel have certificates of competence

In addition, the regulations establish the liability of both operator and diving contractor, and require insurance.

The Geophysical Regulations contain one approval—an Authority-to-Conduct-a-Geophysical/Geological Survey. To obtain approval, the operator must submit a comprehensive description of the geophysical program, including details on the equipment and techniques to be used. COGLA reviews the program to determine if it meets the regulations and grants approval. The regulations also require a report on the program, and the filing of shot hole data. The seismic field operations are inspected regularly.

The Production and Conservation Regulations feature one approval—a "Production Operations Authorization". This authorization is granted after the production installations have been constructed, put in place and are complete and ready to operate. As a condition of that approval, the operator must obtain a Certificate of Fitness.

These regulations also specify the standards that the production and processing equipment must meet. They require that equipment be inspected and tested before start-up. They also establish the requirement for reporting production and for an annual report on reservoir performance.

Although they contain no specific approvals, the Installation Regulations:

- Specify the analyses and evaluations that must be done—for example, safety analysis and fatigue analysis
- Specify the loads that must be considered and how they are determined
- Specify the properties of materials used
- Specify acceptable safety factors and acceptable standards
- Require the protection of the installation—for example, against corrosion and against fire

- Prescribe the requirements for personnel protection such as, lifesaving, active fire fighting systems
- Require site investigations
- Require an operations manual
- Require regular monitoring/inspections

They also form the basis on which a Certificate of Fitness can be granted.

The Certificate of Fitness Regulation establishes the criteria for a valid certificate and identifies who is authorized to issue a Certificate of Fitness. The four organizations that have been approved are:

- American Bureau of Shipping
- Lloyd's Registry
- Det Norske Veritas
- Bureau Veritas

The regulations also:

- Specify the criteria that must be in order before a valid Certificate of Fitness can be issued
- Specify that the certifying authority must carry out an approved scope of work
- Specify the circumstances under which the Certificate of Fitness becomes invalid and the consequences
- Specify how a change of a certifying authority may take place

The Offshore Pipeline Regulations:

- Specify design criteria and methods
- Specify the materials and construction procedures
- Require that pipelines are inspected and tested before operation

The Operations Regulations set out who can obtain an operating licence and how it can be obtained. They also prohibit any work or activity without specific authorization. These regulations provide a catalogue of eligible persons or companies that plan to work on frontier lands.

The Spill and Debris Liability Regulations prescribe an operator's limit of absolute liability for spills and debris that may result from his operations. The limits are $10 million for an incident on land but not near a waterway, $25 million for an incident near a major waterway and $30 million for an offshore incident.

COGLA is responsible for one additional approval—the Development Plan Approval. The Act stipulates that no approval for work that involves the development of a field is valid unless there is an approved development plan for that field. The approval process for the development of a large field such as Amauligak is extensive.

As a first step, the operator must prepare a comprehensive development plan. This plan must describe in detail how the operator intends to develop the field. It includes:

- Information on the scope, the purpose, the location, the timing and the nature of the proposed development, and the physical environment conditions at the location
- Information on the production rate, on how the field was evaluated, on the estimated amounts of oil and gas expected to be recovered, the reserves, the recovery methods including secondary recovery, and the production monitoring procedures
- The estimated cost of the development
- Both preferred and alternative production systems that could be used in order to ensure that the best possible system is chosen
- And finally, technical or other information and studies necessary for a comprehensive review and evaluation of the proposed development

On the environmental side, the plan must include an Environmental Impact Statement that describes both the physical and biological environment, and the environmental impacts that are likely to arise from the project. This statement must also include the mitigative measures that the operator will be prepared to take.

In addition to the Environmental Impact Statement, the operator must provide a Benefit Plan, which sets out how the operator intends to ensure that Canadians and Canadian manufacturers will be given a full and fair opportunity to participate.

COGLA studies the plan thoroughly. Where there are deficiencies, the operator is asked for more data and may be asked to undertake further work or studies. The complete assessment is undertaken in consultation with experts in other departments. If necessary, COGLA will engage outside experts to assist in the evaluation.

When COGLA is satisfied that the development plan provides a framework within which a successful, safe, pollution-free project can be carried out, it approves the plan.

Coinciding with the development plan assessment, there will likely be an environment assessment and review following the EARP process. This process independently assesses the environmental and socio-economic impacts of the project. In most cases, it will include a public review and public hearings. As recent court cases have demonstrated, EARP has become an essential part of the process for approving any project in which the federal government is involved, either as a regulator or as an interest holder.

Once the development plan has been approved, the operator can commence with the major engineering and construction activities knowing that the work can be used in successfully completing the project. However, the operator must also comply with the relevant regulations under the Oil and Gas Production and Conservation Act in carrying out the project.

I will close at this point. I have given you a lot of detail on the regulatory framework within which we work, but it is important to realize and understand that there is also a body of standards and requirements to which industry is being asked to conform. I hope that knowledge will give the public some confidence that the industry is being truly challenged in its offshore developments.

In summary then, although the regulation-making process is not complete, we are well along in defining the requirements, standards and criteria that must be met in carrying out work or activity on frontier lands. With continued co-operation of the industry technical committees and support and expertise from our colleagues in the provinces and offshore boards, I hope that all the essential regulations will be finalized before we meet here again.

AL LYMER:

Thank you, Glenn. I did not know what you did in Ottawa and now I do. Ten regulations. Mo, that fellow needs a raise. No more tax increases though: a raise can be within your budget.

Our next speaker, representing the Northwest Territories, is Graham Nichols. Pierre Alvarez is listed on your program, but unfortunately is unable to come. Graham Nichols is a very adequate replacement. Graham started working with the government of the NWT in 1986, initially as Energy Advisor with the Energy, Mines and Resources Secretariat. Since 1988 he has served as the Director of Policy and Economic Analysis in the new department of Energy, Mines and Petroleum Resources.

Prior to moving to Yellowknife, he worked for BC Hydro where he was responsible for public consultation programs with the Public Affairs Division and as a system planning analyst in BC Hydro's gas division.

A native of Vancouver, he has earned a BA in political science and an MA in community and regional planning at the University of British Columbia. That latter degree is recognized in Alberta.

Let us welcome a most knowledgeable individual—particularly in matters of the North—Graham Nichols.

GRAHAM NICHOLLS
Government of the Northwest Territories

Thank you, Al, ladies and gentlemen. I apologize for stepping into Pierre Alvarez' shoes today. He has to attend a number of cabinet meetings about some of the issues that I will discuss with you today. I will turn to my slides in just a minute.

As Mr. Epp pointed out this morning, formal discussions will begin soon on the Northern Accord between the Canadian and Territorial governments, and between the Canadian and Yukon governments. These discussions come at the same time as we are looking at the finalization of the various aboriginal land claims agreements in the north. There will be busy times ahead, then, in terms of the implementation of this and other agreements.

As you know, the east coast accords establish the sharing of certain responsibilities in the offshore. The Northern Accord, with both the Yukon and Northwest Territories, is different in two respects. We are talking about the transfer of responsibilities of onshore as well as offshore management, and probably the transfer of responsibilities for the onshore is more significant. As well, we are dealing with the simultaneous implementation of land claims, and there is a need for a lot of co-ordination between these two processes.

Al indicated this theme—the Regulatory Environment—is the way it is. Not yet. For us in the north, it is the way it will be, or perhaps it may be, depending on your point of view. At any rate, the government of the NWT is a prospective regulator but does not, at this time, have any direct responsibilities for the management and regulation of oil and gas. Nor does it, nor will it, be looking at the ownership of oil and gas—at least not through this process.

Why are we looking at the Northern Accord? Why is it important? First, northern residents want northern control over the management of resources on their own land. They seek a further political and constitutional development of the NWT, with the territorial government having responsibility for oil and gas, as well as other land and resource management functions. These responsibilities will be possible with the finalization of claims. This will give the territorial governments virtually the same array of powers and responsibilities as the provincial governments have today.

People of the north also want to see economic development proceed. Through the completion of the claims process, the Northern Accord and other areas of devolution this becomes possible on acceptable terms.

There is obviously an opportunity, as I have already indicated, for co-ordination of the implementation of the Northern Accord with the implementation of land claims. There will be a number of complex years ahead of us in terms of establishing the new legislative regimes and regulatory regimes—not only for oil and gas but also for the management of land, water, environmental renewable processes and land use planning processes, etc. In terms of the Northern Accord, we are only dealing with oil and gas

management per se. As Mr. Epp indicated earlier today, the Northern Accord is also consistent with federal policy, the frontier energy policy, the east coast accords and the ongoing devolution on the part of Indian Affairs to the government of the NWT.

The present process is an enabling agreement or an agreement-in-principle signed between the government of the NWT and the Prime Minister of Canada in September of 1988. Since then, there have been a number of in-depth consultations particularly with the aboriginal groups—the Inuit of the Eastern Arctic, the Inuvialuit, and the Dene Nation and the Metis Association. We have had a lot of involvement in working on the development of the accord proposals with those groups. There have also been a series of meetings with individual members of industry as well as with CPA, northern operators, and the Yukon government. These efforts are intensifying now.

We have developed a very substantial Northern Accord proposal, and we hope to begin formal negotiations and discussions quite soon. We are also busy with ongoing policy development work in such areas as royalties, northern benefits, and management of exploration rights. I do not think that anybody should expect to see a devolution of responsibilities to a government that is not prepared to indicate how it intends to utilize those responsibilities to the best of its abilities within its resources. In the area of royalties, we are considering particularly the application of the royalty regime in the onshore areas and more southern parts of the NWT. These areas do not lend themselves as readily to the draft royalty regime, when companies are looking at small-scale projects using conventional technology, as opposed to the Amauligaks and the Taglas.

In addition, Northern benefits and their relationship with the management of exploration rights are fundamentally very important areas. We can see a lot more activity along these lines with the completion of the Dene/Metis claim and, we hope, the issuance of new exploration rights in the valley. We are preparing a discussion paper on how we intend to manage northern benefits along with exploration rights, with particular emphasis on onshore activities. We are also developing legislation, which I will come back to later, and we hope to begin negotiations soon with the government of Canada.

The principles that are particularly applicable to the Northern Accord are:

- The transfer of provincial-type powers and responsibilities for the onshore, consistent with the various devolution exercises that have been completed to date
- A shared regime in the offshore, as we have already seen with the other accords
- A recognition of the role of the Yukon territorial government—particularly in those areas of the Beaufort Sea adjacent to its coast
- A cost-effective, efficient and stable administration that is compatible with land claim structures

We are looking at the establishment of exclusive powers and responsibilities within the territorial government for the onshore. We propose the establishment of a technical regulatory board, which would be based on an amended OGPCA. We have already developed a draft form of the amendments. And there will be a department responsible for the various policy issues, such as royalties, northern benefits and rights management, which will broadly parallel those functions called for under the CPRA. We see these regulatory precedents as perfectly good and workable in the North, and we see no reason to embark on an exercise of developing wholly new pieces of legislation.

The offshore responsibilities would be shared with the government of Canada. There would be a technical regulatory board, based on an amended OGPCA. This board would include a role for the Yukon government, with respect to the Beaufort Sea.

Our proposal for territorial decision-making would be in the same policy areas that apply to the onshore, based on existing legislation and regulations.

As I go through the parallels between the structures for the onshore and the offshore, the important principles are the establishment of a critical mass of work and a demand for human resources in the North in order to establish an efficient and effective administrative structure. With more work we will acquire more expertise, and become more efficient. Instead of dividing up the administrative supports in various parts of the country, we are trying to consolidate them as much as possible in one area, serving both the onshore and the offshore.

On the issue of effectiveness and efficiency, we would see expertise in the North phased in following the signing of the final accord agreement. While that expertise is being developed we would, of course, have to continue to rely on the support of federal agencies, in particular COGLA. We will have to negotiate new agreements to provide for the services required from the federal government, particularly in the onshore. A single office and staff for the onshore and the offshore will provide one support administration. This is one element that we heard quite clearly when the CPA addressed us some time ago on what it was looking for through the accord.

It is particularly important that what we do is compatible with and consistent with land claims. Aboriginal groups are integral to the processes that we have been following and, incidentally, we have been satisfied and heartened by the nature of their participation in the development of our proposals. Of course, there will be a plethora of new administrative structures and requirements for legislation to implement the land claims. I would remind you that only one of the four major claims in the NWT has been settled; the others are at the final agreement stage. The process for implementing those last claims will be very complex, and we will have to accommodate and adjust accordingly. It is very important to realize that the Northern Accord is not a land claims process, nor does it affect what happens through the land claims process.

Finally, in terms of timing and implementation, this is one scenario. It is probably safe to say that we are following something like an Esso Resources Canada approach to the Mackenzie Delta gas development—step by step. We think that it is a realistic expectation that the final accord agreement could be signed in the fall of 1990. There would then be established interim committees with representation from the territorial government and the federal government. All decisions would flow from that committee and then be referred to the Ministers. An Order in Council providing for a transfer of legislative responsibilities could be in place quite soon after the signing of the agreement. The transfer would enable the territorial government to pass oil and gas legislation which, as I have indicated, we have been developing. We would, of course, be prepared to discuss the proposed legislation with industry in terms of any changes or adjustments that it would like to see. We feel that the legislation could be put through the House by the spring of 1991. During 1990-1992, we would concentrate on the development of local expertise. This is one of the major components of the entire exercise. We want to ensure that we have the appropriate skills and management in place in the north. Without it, nothing is going to work.

Federal legislation would have to be amended. We feel that this could be done at one time, i.e., in the fall of 1992. There will be a withdrawal of the application of federal legislation for the onshore and changes in the offshore so that the territorial government can take a legislative role there. Later, say in 1994 or 1995, there would be the establishment of an offshore implementation act, and the establishment of the offshore board. We can expect to see the establishment of the final structures in the onshore somewhat sooner than those in the offshore. This is consistent with what was contemplated in the agreement-in-principle as well as with the principles of the phased nature of development.

AL LYMER:

Thank you very much, Graham. You are a very able replacement, and I am sure that there are many of people here who have heard this presentation for the first time. It was very interesting. Thank you.

The next speaker, Mr. Fred Weir, is Chairman and Chief Executive Officer of the newly formed Canada-Nova Scotia Offshore Petroleum Board (CNSOPB). Fred spent 32 years in the oil and gas business, 12 of which involved the management of offshore exploration and production projects with Mobil Oil Corporation. He was General Manager of an offshore project in Norway, and he was also the Manager when it operated in the field. He became Chairman of the CNSOPB in October 1989, and an asset came to Fred at that time when Andy Parker also joined the Board, as Operations Manager.

Let us welcome Fred Weir to our session today.

FRED V. WEIR
Canada-Nova Scotia Offshore Petroleum Board

Thank you very much, Al. It certainly is a pleasure to be here. The Canada-Nova Scotia Offshore Petroleum Board is relatively new to the frontier petroleum scene so the first thing I will do is introduce you to the Board.

The Canada-Nova Scotia Accord was signed in August 1986. The jurisdictional question was set aside and it was agreed there would be neither federal nor provincial management of the offshore Nova Scotia resources. Rather, there would be an independent Board to manage the offshore petroleum resources on behalf of both governments. There would be mirror implementation legislation based on federal oil and gas laws, but revenues from any development would be paid to the province as if the resource were on land. The accord legislation was proclaimed on January 5, 1990, and the Board was established at that time. So we are the new kids on the block, being in existence for just three or four months now.

We are a small group totalling 14 people and we intend to stay at that level. The Board will emphasize the environmental aspects of offshore Nova Scotia as shown in this organizational chart with our Senior Environmental Advisor reporting directly to the Board Chairman. We put a lot of emphasis on the environment and will continue to do so. The Board will also have a Chief Safety Officer who will be required to give approval prior to any offshore activity proceeding. We, of course, have all the other technical Board functions such as offshore operations, offshore resources and Nova Scotia-Canada benefits management, etc.

The Board itself is composed of the Chairman and four members. The Chairman is appointed jointly by both governments. The provincial and federal governments each appointed two members, including one civil servant each from their respective jurisdictions. This is unlike the practice in Newfoundland where there are no civil servants on the Board. The function of the Board is to set the policy for offshore Nova Scotia, and the function of the technical staff is to see that these policies are carried out.

Naturally, we are anxious to see things happen offshore Nova Scotia and in that regard we will work with industry and other interested parties as much as we can. Our task also includes ensuring that offshore activities are carried out safely, that oil and gas resources are produced in an economical manner and that other marine resources and dependent users are protected.

The Board is responsible for administering the legislation and regulations pertaining to all aspects of the exploration for and the production of hydrocarbons in the Nova Scotia offshore area. This includes safety, environmental protection, Nova Scotia and Canada benefits that may accrue due to offshore development, exploration rights such as exploration licences, approval to drill wells, significant discovery licences, and production licences. We also regulate all offshore operations by evaluating exploration and production programs as they are submitted by operators, determining under what conditions they can proceed, and monitoring the operations as they are carried out.

There is a project currently underway offshore Nova Scotia in the Cohasset-Panuke area, southwest of Sable Island. It is an oil production project operated by LASMO Nova Scotia Ltd., and it is scheduled to come on stream in the summer of 1992. It is a small, modest project compared to most offshore oil developments. It is, however, a first step for offshore Nova Scotia, and, for that matter, offshore Canada. Production will be about 25 000-30 000 barrels per day operated on a seasonal basis, and it will average about 16 000 barrels per day on an annual basis. In other words, production will only be on stream during the seven or eight months of good weather. During the four or five winter months, production will be shut in and well maintenance carried out. The life of this development will be about five or six years.

The development application for this project has been submitted to the Board for evaluation. It is a project that involves drilling and completing subsea production and water injection wells at Panuke, producing to a wellhead jacket and flowing the production via subsea pipeline to Cohasset. At Cohasset, there will be a jackup production platform with production and injection wells. A converted jackup rig will be used as the production platform where oil treatment will take place. Produced oil will be shipped to a storage tanker and be offloaded for market to a shuttle tanker.

Currently, the Board is evaluating the development application. Let me explain to you how this is being done.

The evaluation of this project has been divided into two review situations. One deals with the socio-economic and environmental aspects of the project and the other is the technical review. Today I would like to touch on the socio-economic and environmental program to illustrate what we are doing in Nova Scotia to ensure that the public interest in offshore development and related resources is optimized.

The Board has implemented a public review process of the environmental and socio-economic implications of LASMO's proposal to develop the Cohasset-Panuke oil reserves. This process is being conducted under the authority of Section 44 of the Accord Implementation Acts with the Board sponsoring public review. The timing and schedule are thus set by the Board. In determining the schedule, the Board has attempted to allow for full participation by the public and, at the same time, keep the schedule reasonable for the size of this project.

This overhead outlines the sections of the Implementation Act that allows the Board to review any project offshore Nova Scotia. The Board may conduct a public review, establish terms of reference, appoint a Commissioner, hold public hearings, and require the proponent (in this case LASMO) to make available for public distribution a preliminary development plan, an environmental statement, a socio-economic impact statement and a preliminary Canada-Nova Scotia benefits plan.

To date, the Board has appointed a Commissioner to conduct this review. The Commissioner is supported by an executive secretary who is an

expert in both the public review process and in the assessment of environmental effects. Resources are also available to the Commissioner to acquire additional expertise to support this review.

The Board has used the Federal Environmental Assessment Guidelines as a model in developing the review process. The staff at the Federal Environmental Assessment Review Office (FEARO) has worked closely with the Board and has been generous with its resources in helping the Board to design a credible process.

The process is outlined in this overhead, which, I admit, is a very simplistic picture of what really takes place. It includes a public review period of 90 days, public information sessions and formal public hearings. The Board initially screened the application to determine whether it should approve the project, reject the project or have further review. We have, of course, opted for further review because of possible public concern over any offshore development.

When making the decision at the screening stage, we considered a number of factors: that the proponent was using standard, state-of-the-art technology; that production will be a very light oil or actually condensate at 52 degrees API; that the project relies on tanker technology; and that it is the first offshore development in Canada. It is also important to note that the region has received an intensive environmental review for gas and condensate production at Venture. The evidence presented suggests that the light condensate, if spilled, would dissipate in hours. Because of the rapid evaporation, there would be no heavy oil slicks or threat to the land. For safety reasons production will be seasonal, with the operation shut in during the harsh weather of the winter months.

Even though the project appears to be extremely safe environmentally, it was the Board's view that further public review of the project was warranted. We believe that matters such as the introduction of floating storage and associated public concerns with any offshore development require public scrutiny.

This overhead shows the schedule of the Cohasset-Panuke development program and demonstrates the nature of the process adopted by the Board. The Commissioner and his staff have been appointed, they have reviewed the project submission for deficiencies, and they have held public information sessions. Parallel to this, the Board staff is reviewing the process for technical merit. These activities will come together in mid-June of this year, at which time the Commissioner will hold formal public hearings at a number of locations in the province and submit a report to the Board on his findings. The Board will then send their decision report to the federal and provincial Ministers for their approval and agreement.

In describing this project, I have touched on the environment and how it relates to our current activities offshore Nova Scotia. However, as I am sure you are all aware from recent court decisions on issues associated with the construction of dams on the Rafferty/Alameda and Oldman Rivers, there is the

potential for significantly altering project economics. In some instances, this could make or break a project.

Let me describe the Canada-Nova Scotia Boards' thinking on these issues.

The Board anticipates continuing to manage the offshore environmental process on a "one window" basis, on the assumption that this will simplify the approval process for industry. In effect, the Board will co-ordinate with all regulatory offices, instead of requiring an operator to clear a project through individual regulatory agencies. There are a number of government agencies that have interests and decision-making responsibilities in offshore development. Some of the legislation administered by these agencies are illustrated in this diagram. The Canada-Nova Scotia Offshore Petroleum Board will develop memoranda of understanding with key government agencies to facilitate the co-ordination of these interests, particularly during the review of applications for exploration and development. Co-ordination should help to resolve potential administrative conflicts, and thereby enhance the efficiency of the regulatory process at least from industry's point of view.

The Board feels that the administrative regime is relatively straightforward and understood for ensuring that operators undertake activities to monitor environmental conditions for the protection of offshore personnel and equipment. The regime is common to all Canadian offshore areas and consists of guidelines that govern the taking of marine and meteorological observations and those that govern forecasting of marine and aviation conditions.

However, conflicts between competing resource users or competing values associated with the use of resources are increasing in Canada. Conflict between the forest industry and conservationists is an example common to all parts of the country. In the offshore Nova Scotia area, the principal conflict is between the fishermen and the oil industry. Over the past decade, the traditional method of managing such conflicts was through consultation, on occasion, negotiation between affected parties, or arbitration through a public review process or independent environmental assessment panels. Such processes are often cumbersome, slow and ineffective, especially with legal wrangling over process. As values change and resources become even more scarce, we can probably expect such conflicts to increase.

It is the Board's view that managing conflict resolution will become an increasingly important component of the overall management of offshore resources in the future. It is also our view that ways and means can be found to promote the resolution of such conflicts to the benefit of all interests. As the lead agency for the administration of offshore petroleum resources, the Board could be instrumental in developing and implementing such procedures.

This overhead summarizes the approach used by the Canada-Nova Scotia Offshore Petroleum Board to promote the resolution of conflicts in the Nova Scotia offshore. Applications are reviewed by the Board and other government agencies to ensure that regulations and procedures designed to

protect public resources are being adhered to. At the same time, or prior to the submission of an application, the Board encourages industry to consult with interest groups, including other marine users. If appropriate, the results of these consultations can be made part of the terms and conditions for approval of an application.

The Accord contains provisions to promote such consultation with the fishing community through the establishment of the Fisheries Advisory Committee, a committee of fishermen and fishery regulatory authorities that can assist in the resolution of potential conflicts. We hope that this will minimize conflicts between users. Communication is the key.

Now let me turn to the approval process the Board will be using for safety-related aspects of offshore operations. Glenn Yungblut has outlined the legislation and regulations that govern activity for Canada Lands. Under the Canada-Nova Scotia Accord this legislation has been incorporated in Part III of the Accord legislation.

This legislation was proclaimed in January 1990, and it is now in effect. There are currently no regulations formally promulgated under this legislation, but the provisions in the draft regulations will be used in Nova Scotia until the regulations are in place. The regulatory framework showing the relevant legislation and regulations that will be used are shown on this overhead.

The safety related amendments to the Oil & Gas Production Conservation Act (OGPCA), which was addressed by Glenn Yungblut, will also be incorporated in Part III of the Accord legislation. The Canada-Nova Scotia Offshore Petroleum Board has determined it would be appropriate to incorporate the upcoming amendments to Part III in its current approval process for activity offshore Nova Scotia. We are, in fact, using them for the activity going on there now.

This overhead illustrates the two major impacts of this approach on industry. First, the operator must provide a declaration stating that the facilities and crew are fit for the intended use, and that the personnel are properly trained. Second, a Certifying Authority must provide a Certificate of Fitness, which states the facility is fit for the purposes and satisfies the requirements in the regulations.

The requirements for issuing a Certificate of Fitness are outlined in the Certificate of Fitness Regulations. These regulations indicate the provisions of the other regulations that installations must meet before a Certificate of Fitness is issued. This overhead indicates the regulations referred to: drilling, installation, regulation, occupational safety and health, and diving.

To ensure that the Certifying Authority does a thorough job in reviewing an installation prior to issuing a Certificate of Fitness, the regulations require that a scope of work for the Certifying Authority be agreed to by the Board. This overhead shows an example of this scope of work. It is a comprehensive review.

This process applies to mobile Offshore Drilling Units being used for exploratory drilling. In the case of a MODU, which is classed with another Certifying Authority, the Certifying Authority providing the Certificate of Fitness could rely to a large extent on the work done by the class society. However, it still has to do sufficient work to satisfy itself that the unit meets the requirements of the regulations and is fit for service.

This new process for offshore Canada is one that was designed to provide a high level of safety for offshore activities. The Canada-Nova Scotia Offshore Petroleum Board will be the first in Canada to use the system and thus both the Board and industry will be trying to achieve a level of comfort with the process. There may be some problems in developing this system and establishing the process. However, the involvement of the agencies with the level of knowledge contained in the Certifying Authorities can only help to ensure that activities are undertaken in a safe manner, which will benefit both industry and the regulator.

In closing, I would like to say a few words on how we see the future of offshore Nova Scotia.

The Canada-Nova Scotia Offshore Petroleum Board is now in place. As I said earlier, we want things to happen offshore Nova Scotia, and they have started with the Cohasset-Panuke development. We feel, however, there is a large potential of undiscovered reserves, as shown by this overhead. We hope that companies that are interested in smaller offshore developments may come forward. The Board will do everything we can to be sure that the maximum co-operation between industry and the regulator is achieved.

Drilling operations offshore Nova Scotia reached an all-time low in 1989, with no reported rig activity. A review of the seismic and drilling history perhaps suggests that we could be at the threshold of a new and challenging exploration cycle.

The beginning of this new cycle of activity was initiated last summer with the issuance of three new exploration licences west of Sable Island near the Cohasset-Panuke and Thebaud significant discoveries (E.L. 352, E.L. 353, and E.L. 354). Each licence has a term of six years, consisting of two consecutive periods of three years each with the requirement to commence the drilling of an exploratory well during the first period. The Board is presently reviewing a drilling program application from LASMO Nova Scotia Ltd., which calls for the drilling of at least one exploratory well on E.L. 352 this year. Two exploration wellsite seabed surveys have been completed this year to date and a 3-D plus conventional 2-D seismic program is ongoing.

Further to last December's closing date for nomination of lands to be considered for future Calls for Bids, the Board has issued a Call for Bids to seek an exploration licence for the parcel highlighted in blue on this overhead just south of the Panuke discovery. Bids will be received until 14:00 A.D.T. on July 5, 1990. In addition to this Call, the Board has designated June 29, 1990, and December 21, 1990, as new closing dates for the submission of nominations of lands to be considered for future Calls for Bids.

So, we are looking for a new era in exploration and production activities offshore Nova Scotia. The Board is in place to help it happen.

AL LYMER:

Thank you very much, Fred, for a very thorough walk through the Canada-Nova Scotia Offshore Petroleum Board. Good luck in being the new player on the block, as you have indicated, and good luck with Andrew Parker.

Before I introduce the next speaker, it may be appropriate to take a mini aerobic break. That means I want you to blink the eyes fifteen times very quickly. If you do not want to do that, you could stand for thirty seconds and stretch before we go on.

A native Newfoundlander, John Fitzgerald graduated from Memorial University in 1962 before spending ten years in the electrical utility industry in Nova Scotia and Newfoundland. He served as Newfoundland deputy minister in the departments of Mines and Energy and in Intergovernmental Affairs before being appointed deputy minister of the Newfoundland and Labrador Petroleum Directorate between 1983 and 1985. Since 1985 he has been Vice Chariman of the Canada/Newfoundland Offshore Petroleum Board, where he has particular responsibility for the environmental affairs and safety operations.

Ladies and gentlemen, please join me in welcoming John Fitzgerald.

JOHN FITZGERALD
Canada-Newfoundland Offshore Petroleum Board

Thank you, Mr. Chairman. I think Fred observed that it is hard to avoid being repetitious. I do not think it is possible at all, especially when you come as late in the program as I am doing today. Nevertheless, I will try not to repeat things that have been said before today or even in previous conferences.

Within the context of the "Bringing it to Market" theme for this workshop, we were asked to provide an update of the evolving regulatory regimes in our respective areas: and first, to comment on the state of readiness of the regulatory system to deal with prospective developments; and second, to discuss whether there were any particular aspects of our regimes that would likely help or hinder developments. I will attempt to deal with those questions in that order.

First, I should say that I consider the regulatory regime to be comprised of the applicable legislation (i.e., the Acts and the Regulations) and the institutions that have been established to administer it.

I will touch only briefly on the genesis, role, function and organization of our Board because the Board's former Chairman, Mr. Baugh, dealt extensively with those matters in his presentation to the 1988 Fairmont Workshop, and the details are recorded in the Proceedings of that conference.

Also, because the legal responsibilities of the Newfoundland and Nova Scotia Boards are very similar, with both administering virtually identical statutes and regulations (indeed, the legislation implementing the Canada-Nova Scotia Accord was modelled on the earlier Canada-Newfoundland legislation), and as Mr. Weir has described these matters in his presentation, I will try not to repeat that material either.

However, for the benefit of those who are not completely familiar with the evolution of the regimes on the east coast, I would like to take a few minutes to review the milestone events for the Newfoundland Board (Figure 1) and to describe very briefly a few important differences between the Newfoundland and Nova Scotia Boards.

Figure 1 Canada-Newfoundland Offshore Petroleum Board Milestones

- 1985 (Feb) Atlantic Accord Signed
- 1985 (Dec) C-NOPB Executive Appointed
- 1986 (Jan) C-NOPB Staff Hired
- 1986 (Jun) Hibernia Decision 86.01 Issued
- 1987 (Apr) Legislation Promulgated
- 1988 (Dec) Development Guidelines Published
- 1990 (Feb) Hibernia Commercial Discovery Declared
- 1990 (Mar) Hibernia Production License Issued
- 1990 (Apr) Hibernia Certifying Authority Scope of Work Accepted

The CNOPB came into being as a result of the Atlantic Accord between the governments of Canada and Newfoundland. This agreement, signed in February 1985, was the first of what is now a series of similar federal-provincial and federal-territorial agreements concerning petroleum resources management in Canada's frontier areas.

The Board is comprised of seven members, a Chairman, jointly appointed by the government of Canada and the governments of Newfoundland and Labrador, and six other members, three of whom are appointed by each government. Two of the latter six members are designated by both governments to serve with the Chairman in full-time capacity as Vice-Chairmen, and these three constitute the Executive Committee of the Board. The other Board members serve part-time. No member of the public service of Canada or of Newfoundland may be a member of the CNOPB.

The members of the Board's Executive Committee assumed their positions in December 1985, and most of the staff arrived in January 1986. For the first year of its existence, the Board operated in accordance with the Canada-Newfoundland Atlantic Accord Implementation Acts in their Bill form, while they were making their way through the Parliament of Canada and the

Newfoundland House of Assembly. During that time, for statutory authority we relied on the CPRA and the OGPCA when necessary.

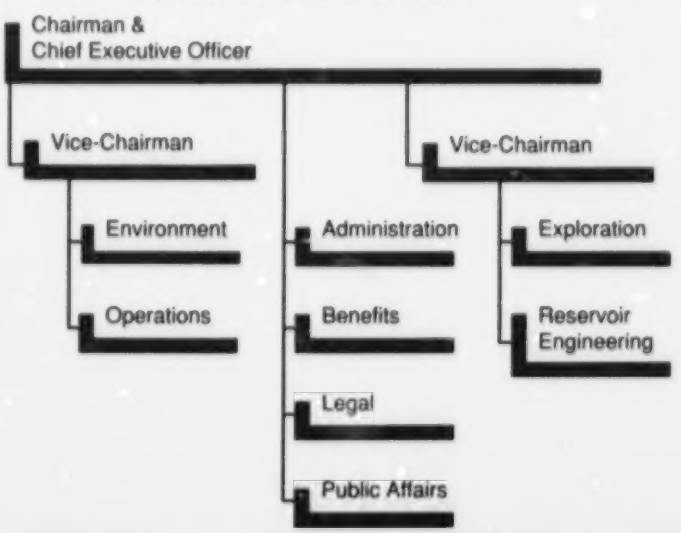
It was during this period that the Board considered Mobil's application for approval of the Hibernia Development Plan, using the draft legislation as a guide, and issued its decision on that application in June 1986. During the previous year there had been an extensive public review of that application under a joint federal-provincial process, which was modelled very closely on the FEARO process—the panel was appointed jointly by both levels of government, and the terms of reference for the panel were established by both orders of government as well. That panel reported its findings at the end of 1985, and, when the Board started up in the first part of 1986, that report was made available, along with the technical work that had been done by COGLA and Newfoundland Petroleum Directorates staff. The Board was, therefore, able to give its approval of the Hibernia project in June of that year.

The Atlantic Accord legislation was proclaimed into law in April 1987, but the Board has, in fact, completed four and one-half years of operation.

More recently, in March of this year, the Board issued its first Production Licence, for the Hibernia field, and in April it accepted the proposed Scope of Work for the Certifying Authority for the Hibernia development project.

The Board's organization is illustrated in Figure 2. You will note that we have tried to maintain an explicit separation between the function of the resource management/conservation and safety of operations/environmental protection. Those areas of responsibilities report to two different Vice-Chairmen. We presently have a staff of 55, and we expect to be stable at about that level for the next couple of years, possibly with some modest growth as a result of the Hibernia and Terra Nova development projects.

Figure 2. Organizational Structure
Canada-Newfoundland Offshore Petroleum Baord



While the statutes under which the Board operates have been in place since 1987, most of the regulations for which provision is made in the legislation have not yet been promulgated. Their preparation is, however, well advanced. Of these, the Installations Regulations, the Certificate of Fitness, the Production and Conservation Regulations, and the Occupational Health and Safety Regulations are particularly important for development projects.

The regulations, which are administered by the Board, are established by the governments. The Board does not determine their content nor does it control their progress through the government system. The Board does, however, participate in their preparation and may recommend amendments to them afterwards. While I find myself frustrated at times by what seems to be the glacial speed of the progress of these regulations towards promulgation, I must acknowledge that we are dealing with completely new sets of regulations. Their development requires extensive consultation between governments and industry and among government departments and agencies.

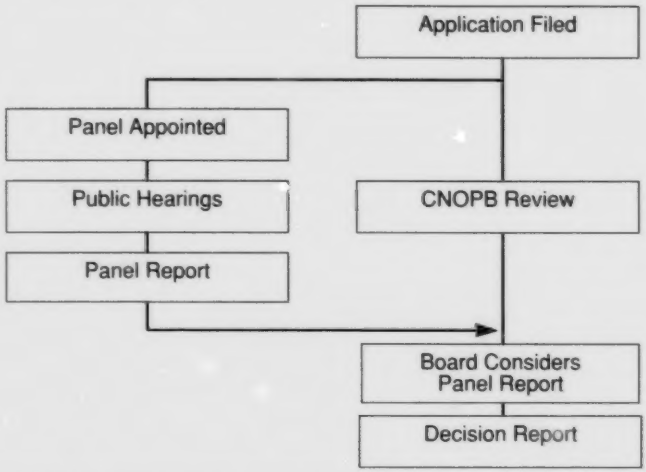
In the absence of promulgated regulations, the Board has required adherence to the latest drafts of them as a condition of its approval of activities. While the Board is empowered by law to do this, we do not believe it is a completely satisfactory approach because it leaves an apprehension in the minds of proponents as to whether the technical requirements will change after an activity is started or committed. For this reason, the Board, throughout this process, has directed its staff to give high priority to their participation in the committees working on these initiatives and to provide comprehensive responses concerning regulatory proposals promptly after receiving them for review.

I am pleased to note that the substantive part of the work on most of the regulations is now complete. We are anxiously awaiting completion of the next part of the process: putting the provisions into acceptable legal language and translating them into both official languages at the federal level; the preparation of the companion legal draft a the provincial level; and the promulgation by both governments.

This part of the process, in itself, takes a fairly long time because of the length of the documents and scheduling difficulties. Nevertheless, we hope that these steps can be completed and the regulations promulgated over the next several months.

To help operators and proponents of development projects comply with statutes and regulations, regulatory authorities also publish guidelines on how they intend to administer the legislation. In the Board's case, we published, in December 1988, comprehensive Development Application Guidelines of the Newfoundland Offshore Area. This document describes in detail the documentation that is expected in support of a development application, and the process (Figure 3) that will be followed by the Board in the review process, and it provides information to the applicant on the timing of the various steps in the process. These guidelines also state that for the foreseeable future all development proposals will be subject to a public review.

Figure 3. Development Application Process
Canada-Newfoundland Offshore Petroleum Board



More recently, we have published draft guidelines concerning the certificated training required for personnel working in various positions in petroleum related activities offshore Newfoundland and we have almost completed preparation of guidelines describing how we intend to administer the granting of work authorizations. Under the legislation, the Board is required to approve, in very broad language, every worker activity in relation to petroleum exploration for offshore production of petroleum, and we thought it was time for us to tell industry how we intended to work with that. We will first talk with our government colleagues and the other boards about our intentions and invite their comment so that we can be as consistent as possible. We then intend to go to industry for comment before bringing these things into effect.

The first two sets of guidelines were published by the Board after extensive consultations with industry and government agencies. We intend to initiate consultations on the latter document shortly.

We have published other guidelines jointly with the Canada Oil and Gas Lands Administration (e.g., the guidelines to the drilling regulations and those concerning effluent quality). It is our intention to ensure that, where appropriate, our administrative practices are consistent with those applying in other frontier areas of Canada and, where appropriate, to publish our guidelines jointly with other regulatory authorities.

I want to assure you that we place a very high priority on and expend a great deal of effort in trying to achieve consensus on these matters. Where differences in practice emerge, as they sometimes will, they do so for valid reasons reflecting local conditions or legal requirements.

In order to make sure there is effective co-ordination and avoidance of duplication of work and activities between the Board and other departments and agencies of both governments, we have concluded six Memoranda of Understanding (MOU) involving some 15 departments and agencies of both orders of government.

These MOU's cover environmental matters, marine services, occupational health and safety, as well as industrial and employment benefits. They provide mechanisms for the timely exchange of information and advice among the parties, and they give the board access to the considerable scientific and technical expertise maintained by both governments.

From an organizational and legislative perspective, we believe that the framework exists for developments to proceed with reasonable certainty about what is required.

We can, however, expect increased public scrutiny of the handling of environmental considerations, both by industry, in the way it formulates its development proposals, and by regulatory agencies, in the way they examine those proposals. The number of environmental cases brought before the courts in recent months underlines the increasing public sensitivity to these issues. The decisions in the Rafferty-Alameda and the Oldman River cases, moreover, clearly indicate as much attention will have to be paid to the process by which decisions are made as to the substantive basis for those decisions.

Because of the difficulty of dealing with the consequences of an environmental accident in frontier areas, we believe that there will be increasing pressure on regulators to assure the public that before approvals are given to carry out exploration and development activities, proponents will be required to take every practical step to reduce the risk of environmental accidents to the lowest level feasible.

In summary, I think that the work done in developing regulations and guidelines by both industry and regulatory agencies over the past few years has put us in a good position to deal with prospective developments. The process of consultation, which is used to develop regulations, helps regulators to understand what is practical and why specific requirements are necessary.

There will continue to be a need to amend regulations and administrative requirements in response to technological advances and societal pressures. We can regard the need for these changes as an obstacle to development or as an opportunity to provide a better framework for the execution of future projects.

I think most of us would prefer to take the latter view.

AL LYMER:

Thank you very much John. It was a worthwhile update of the Newfoundland Board's procedures and future direction.

Our next speaker is Mr. Terry Sewell. He is an Assistant Deputy Minister, Economic, Policy, Planning and Research, in the Department of Economic Development, Government of Yukon Territory.

Terry has been with the Yukon government for some eight years, with responsibilities ranging from directing program analysis for the Department of Finance, to transportation policy development, to acting as an Assistant Deputy Minister of Municipal and Community Affairs.

Prior to working with the Yukon government, Terry spent ten years with the Ontario government. According to his backgrounder, his main goal was to get out of Toronto—he obviously succeeded.

Ladies and gentlemen, let us welcome Mr. Terry Sewell.

TERRY SEWELL
Assistant Deputy Minister
Economic Policy, Planning and Research
Department of Economic Development
Government of the Yukon

Thank you Mr. Chairman. On behalf of the Yukon, I want to thank CPA very much for inviting us and asking us to speak to this conference.

First, I want to bring you regrets from my Deputy Minister, Mr. Dan Oden, who was originally scheduled to speak to you. He would have liked to be here in Fairmont.

The Yukon and the Northwest Territories (NWT) are here because the federal government has agreed that we will be involved in the whole oil and gas area. I do not want to pretend that everything is sweetness and light, though, between us and the federal government. I do not know if some of you had that view. I guess it is best typified for me by a story about my experience with the federal government in the Yukon. It is a story about a fellow who joined a monastery. It was one of those monasteries where the men take a vow of silence, but every seven years they are allowed to say two words. The first seven years pass and at the end of it, the head monk comes along and says, "Seven years are up. You are entitled to two words." The guy says, "Food's bad." He signs up for another seven years. After those seven year pass, the head monk comes along and says, "You get two more words." He says, "Bed's hard." Again, he signs up for seven years, and when he reaches the twenty-first

year of being in the monastery, the head monk comes to him and says, "You are entitled to two more words." The guy says, "I quit." The head monk says, "You might as well, you've been bitching ever since you got here."

The precise nature of Yukon's future onshore and offshore regulatory regime hinges on developments in two significant negotiating forums. The settlement of the Yukon Indian Land Claim and the development of the Northern Accord with the Governments of Canada and the Northwest Territories.

I will outline our view of the emerging regime based on a recognition of the principles of stability, predictability, environmental sensitivity and consistency. My points will also represent our preferred view of the outcome of the negotiations noted above.

I probably do not need to underline for you that there are some uncertainties presently associated with developments in Canada's North, at least for the next while.

In our view, Government decisions about oil and gas development take place in two clear stages. The first stage is to decide whether oil and gas development is generally acceptable in a given area. The second stage is to decide whether a specific development proposal can proceed and, if so, under what terms and conditions.

Deciding whether to offer oil and gas exploration rights requires government to assess the general acceptability of oil and gas development in an area. Unless the government intends to allow development of the oil and gas resources found while exploring, there is little reason to offer rights in the first place. Similarly, we believe that when industry has bought into such a process, the rules should not change capriciously.

Once the Government does issue exploration rights, it must take responsibility for assessing and approving specific proposed activities and for reviewing, inspecting and regulating the exploration and development activities that follow.

What follows is a brief description of how these two activities may be undertaken in the Yukon in the emerging regulatory environment. You will notice in this process that we will borrow recognizable components of the approach taken elsewhere in Canada. You will also recognize some unique features which reflect life today in northern Canada.

Through land claims, native people are negotiating their participation in various structures and processes in order to protect their aboriginal rights and interests in Yukon environmental and socio-economic matters.

There are, in particular, two land claims that most affect the Yukon—a settled claim with the Inuvialuit and a claim about to be settled with the Council for Yukon Indians.

THE INUVIALUIT FINAL AGREEMENT

The land area affected by the Inuvialuit settlement is the extreme northern area of the Yukon that drains into the Beaufort Sea. In the offshore this extends over the Beaufort Sea up to Latitude 80°.

Under their signed agreement, the Inuvialuit are guaranteed significant participation in land use planning, wildlife management and environmental screening and review.

An environmental impact screening and review process has been established. This process has the authority to screen all North Slope development proposals to determine whether they have a significant negative impact on the wildlife, habitat o ability of the natives to harvest wildlife.

The screening committee does not necessarily need to act, however. When a proposed development is subject to a governmental development or environmental impact review process, and in the opinion of the screening committee, that review process adequately encompasses the assessment and review function, the screening committee shall refer the proposal to the body carrying out that review process. If, in the view of the screening committee, the government process will not adequately encompass the assessment and review function, it will refer a proposal to the Environmental Impact Review Board for a public review.

The recommendations of the Review Board, like the findings of the Screening Committee, "shall be transmitted to the governmental authority competent to authorize the development".

THE YUKON INDIAN LAND CLAIM FRAMEWORK AGREEMENT

This Agreement was recently ratified by negotiators and principals of the Council for Yukon Indians, and the Federal and Yukon Governments in the wee hours of April 1, 1990.

For Land Use Planning this agreement calls for regionally based planning commissions, with one-third to two-thirds of the membership comprising nominees of Yukon aboriginal peoples, depending on the specific area involved. Yukon aboriginal peoples will also have the authority to prepare sub-regional and district plans for settlement lands within their traditional territories. The planning commissions recommend their plans to the appropriate Minister.

For fish and wildlife management, the agreement provides for the formation of a Fish and Wildlife Management Board with 50 per cent native representation guaranteed. The Board may make recommendations to the Minister on all matters related to fish and wildlife, and will be granted the right to intervene in public proceedings that affect the conservation of fish and wildlife and their habitat in the Yukon.

For surface concerns, a Surface Rights Board is proposed. The Minister will make the appointments, half of which shall be from nominees of the Yukon aboriginal peoples.

For the development assessment process, which was an important component of the sub-agreement to this point, the proportion of Yukon First Nation nominees, appointed by Government to the screening and review bodies, ranges from one-third when development impacts are primarily outside claim settlement lands, to two-thirds where the development impact is primarily inside settlement lands. The agreement calls for assessment and review processes focusing on the avoidance and mitigation of negative environmental and socio-economic effects from development.

Some aspects of the Claim are still being finalized as the umbrella final agreement has only recently been approved. The next approval step is the formal ratification of the agreement by each of the three parties, and even this is not clear at this moment. Ratification by governments will be through their cabinets; the Yukon government has also committed to a public consultation process; and the native people have not yet determined how they will carry out the ratification process. At the same time, a different approach for this claim will result in band-by-band agreements negotiated with each of the Yukon's 14 bands. The umbrella final agreement sets a framework, and then each band will reach its own arrangements within that framework. This is a very exciting and fairly different process.

YUKON GOVERNMENT POLICY INITIATIVES

The Yukon Economic Strategy adopted in 1988, after an extensive consultation process, commits the government to the goal of fostering environmentally sound economic development. The government will try to ensure that those involved in making decisions about resources and the environment—government, business, communities, other people interested or affected—have as much information as possible about the implications of development. This will also mean that all of us, "regulators" and "regulated" alike, will have to work "smarter", with more sensitivity and co-operation between us.

As noted previously, the Yukon government's approach will be to follow an open and active consultative process.

A decision to issue exploration rights in an area will carry with it an implied approval in principle for developing economically viable discoveries, subject to normal terms and conditions, and to sound oil field management practices, with due regard for appropriate occupational, health and environmental considerations.

YUKON OIL AND GAS REGULATORY AND REVIEW SYSTEM

This is the second component of governmental activity: taking the responsibility for assessing site specific proposals and regulating exploration and development activities.

Environmental assessment of site specific plans must proceed through the review processes previously outlined and must satisfy all environmental stipulations.

The establishment of independent boards to enforce technical regulations governing oil and gas activities would be the basis of our regulatory approach. The boards would have complete authority to adjudicate and regulate technical matters related to oil and gas operations. While they would have a great deal of technical decision-making authority, the powers and procedures would be carefully spelt out by the elected governments to ensure that policy decisions cannot be made on matters that are the responsibility of the elected government.

Because of onshore versus offshore differences, we believe there is a need for two boards. It is our hope that a joint regulatory board would be formed in co-operation with the governments of Canada and that of Northwest Territories to handle regulatory matters for the entire Beaufort Sea area. The onshore regulatory role would be carried out by a Yukon energy resources conservation board which may well parallel Alberta's Energy Resources Conservation Board in its areas of responsibility.

The scope of a board review of a major oil development project would include:

- Environmental effects relating to oil and gas field operations
- Socio-economic effects
- Risks to public health and safety
- Conservation of oil and gas resources
- Protecting the rights of other oil and gas rights' owners

The board would have no authority or responsibility for administering the government's resource policy objectives or the fiscal employment or business development objectives related to resource activities. The administrative authority in policy areas would remain with respective government departments.

It is our view, at this stage, that the offshore and onshore regulatory boards would be comprised of members chosen for their professional qualifications and their detachment from any direct interest in the decision required. The fields of expertise that may be represented on the board would include expertise in areas such as oil and gas, socio-economics, environmental sciences, etc.

Finally, we will undertake to share technical expertise, wherever feasible and practical, with our sister territory.

On the matter of transition under the oil and gas accords, I have the following points to make:

- The development of a northern-based regulatory environment will be done in a phased-in, incremental process under the principles presently enshrined in the CPRA and the OGPCA
- The transition of authority in the northern frontier will build a northern policy and encourage oil and gas expertise in the onshore and the offshore

I would like to conclude with this summary:

i. It is our intention and objective that the assessment and screening processes be streamlined to allow parallel consideration of proposals, and perhaps include consolidated public hearings to provide a stage for public information gathering to meet a number of review requirements. We are seeking a process that is fair, predictable, open and co-ordinated to meet the needs of industry, Yukoners—both native and non-native—and Yukon's wonderful natural environment.

ii. The recognition of the aboriginal claim settlements and their terms will have to be clearly stated, understood and co-ordinated with government management structures. As Graham highlighted, this will be a tall order but it is one that, with good will and good effort by all parties involved, can happen.

iii. We believe that the regulatory environment is at an exciting, but early, stage of development in the north. We believe that with the support of industry it can be made to work effectively, and in a way that recognizes the requirements of industry, but that genuinely incorporates the special role and interests of all northerners native and non-native alike.

Thank you for the opportunity to speak to you today.

SESSION IV DISCUSSION

AL LYMER

Thank you very much, Terry, for providing the Yukon perspective on the unfolding of the Accord.

It is time for question period. We will follow the same format that has been carried earlier—give your name and company. We are on time, we are scheduled to quit at 16:45. Barry Virtue has given me a note to remind you that supper will be at 19:00 in this room, and spouses, guests, or those family people that have come with delegates are welcome and encouraged to come.

Let me turn it open to questions from the floor. I believe that our mikes work, and this group is ready to answer any questions that you may have.

ROB JEFFERIES, AMOCO

I would like to address this to Graham Nichols. You were talking about offshore legislation coming into effect is question number one, and, the Dene/Metis claim being finalized. [inaudible]

GRAHAM NICHOLLS

I think there is a whole range of issues involved in the finalization of the Dene/Metis land claim and its implementation, which will take quite a number of years. This is why it is important for us to work with the Dene/Metis to ensure that what we have been doing through the Northern Accord and northern legislation will be consistent and compatible with what they see coming forward through the claim. There will be a number of areas in resource management responsibilities that likely will not be finalized for a number of years after that. Although we can see the certainty of establishing a surface rights board fairly quickly, this is a very important step because of the large land area under their ownership. The establishment of a number of the other decision-making bodies, such as the land and water management boards along with applicable legislation, will take a period of time afterwards.

This is why a lot of work, co-ordination for dealing with the development problems and building new expertise in the north are required in all of those areas. We do not feel that there is any inconsistency, which is what we would be doing in respect to subsurface resource management. We are also aware that the Dene/Metis have a great concern in seeing that the nature of the surface management regime, which is established under the claim, be implemented as soon as possible after, if not before, the final implementation of the subsurface management regime. This is now an area of outstanding concern, which previously we could not control through the court process, but, definitely, the question of the juxtaposition of those two processes is critically important to the exact nature of the Dene/Metis claim. We see this as a step-by-step process towards the working out of these goals. I hope this answers your question.

NORM STROM, ERCB

Mr. Fred Weir—CNSOPB I was struck by a couple of things that you said, one of which was that the Board has been mandated to establish a policy for offshore drilling [inaudible] As I understand it policy is set by Cabinet [inaudible] The second thing was the appointment of a commissioner to hear all public review [inaudible] Can you comment on these?

FRED WEIR

What I said was the Board sets the policy, but what I meant to say was that the Board sets the policy for the Board. [inaudible]

NORM STROM

Please follow that up. Do you administer to the matter of issuing leases and that sort of thing?

FRED WEIR

We administer the matter of offshore drilling rights and things of that kind.

NORM STROM

Do those materialize under the direction of Cabinet?

FRED WEIR

No, they are basically on application now. Obviously, what we go out for is a call for nominations of a plan. First of all, we go to the Ministers and say this is what we are proposing to go out for, and they come back and say, yes okay. Once that is done, the drilling licences and the rest come forward.

NORM STROM

As a referral?

FRED WEIR

Yes.

NORM STROM

What about the commissioner?

FRED WEIR

Through legislation, we have the right to appoint a commissioner and a commission for the hearings that we now have going on. We work very closely with FEARO on this, and it is a mirror policy that FEARO would have followed had they carried this out. They recommended it, and this is what we followed, and this is what the legislation says we should follow. Basically, if you appoint a one man panel—which is a commissioner and a commission—the Board can deal with a multi-person panel [inaudible]

NORM STROM

So the commissioner is really doing a certain type of review?

FRED WEIR

Yes.

NORM STROM

What if you get into a technical area, what would you do then?

FRED WEIR

The commissioner who is selected basically has a very credible background in the area, and he has as much technical help as he needs. In other words, he has a secretary who is well versed in the procedure and environmental concerns, and if he needs more he gets more. He, in effect, is there to run the hearings, and his expertise comes from outside help and he can obtain as much of it as he needs.

NORM STROM

Is this a model that is used in, for instance, offshore [inaudible]?

FRED WEIR

I do not know. But it is a model that was outlined for us and that was approved by us close to two months ago.

STEWART MCCLURE

Terry Sewell or Graham Nicholls, with regards to the onshore or offshore boards, I think you had said that the new board for onshore/offshore is going to be under the control of the federal government. Can we assume that you are discussing the possibility of one onshore/offshore board [inaudible]?

GRAHAM NICHOLLS

In the de facto sense, I would like to say yes, but legally that does not seem possible, because it would be responsible to two different legislative assemblies and two different jurisdictions. So legally there would have to be two different boards. It is our hope to see as much commonality between the legislation, regulations, and, perhaps, even the membership of the boards themselves. Now, that is not impossible, and we can see the same sort of trends applied between the onshore and the offshore. Fundamentally, we are talking about the same function being performed that is responsible, in the case of the offshore, to two governments—the NWT legislation and that of the Yukon. So what you are looking for in a technical sense can be achieved and we are hoping as much as possible to realize that as an objective because, I do not really see that the respective jurisdictions have a fundamentally different attitude about the nature of the powers and responsibilities of the regulatory boards.

TERRY SEWELL

I would agree with most of that, and would add that realistically we do not see a huge volume of activity onshore in the Yukon. Maybe one day some interesting things will happen, but the whole question of volume has to be taken

into account as well. We will be looking for as much consistency as we can, but there will always be the jurisdictional differences to keep in mind.

WES ABEL, MOBIL OIL

Glenn. when he talked about instruments, said something about making regulations. John, when he talked about implementing regulations, and Fred, when he spoke about single regime [inaudible] Could someone from that group clarify exactly the process by which we could be affected in business? We do have a lot of consultation with all groups and do spend a lot of time with various people. I spent a lot of time with [inaudible] In the end, we still have to work under a single regime and a single set of regulations.

GLENN YUNGBLUT

It is a difficult problem because there are so many different groups that have a vested right in the development of these regulations. It becomes very complex in making sure that everyone is consulted, everyone becomes involved in the process. I am not sure if there is an easier way of streamlining it much more than it is at the moment. We work very closely with our associates in Nova Scotia and in Newfoundland through our two boards and also on some of the legislation that is in the federal area. We recognize the burden that this places on industry to participate in all this work, but I do not think that there is much we can do to make it less onerous—other than to get the regulations in place and then we can all sit back and take a deep breath and hope.

JOHN FITZGERALD

I do not know if I can add much to that, except perhaps to observe that the substantive part of regulations that appear under the Accord legislation in Newfoundland and Nova Scotia is exactly the same as that which appears under the two federal Acts. [inaudible] As I mentioned in my remarks, we have agreed that the federal version of these regulations will go through the line first, and the provincial legislation will come later with the appropriate language changes to reflect the Act and the fact that it is the board, instead of the Minister, and that kind of good stuff. But, the substance of the thing is exactly the same in each case. What may be giving the industry a little bit of heart-ache is that, because the Accord's provincial version has this language change it is also sent out for review and comment. As I understand it, the industry has sometimes used this second look to lobby for substantive change that they were unsuccessful in getting on the first pass, and I suppose that is understandable when you give somebody another chance and invite comment.

In most cases the substance is exactly the same. If you did not get it the first time round—we are all committed to trying to have it consistent across the various jurisdictions—there is not much chance of getting it on the second pass if you did not get it the first time. In fact, industry has been one of the strongest proponents of consistency across the jurisdictions. It has put us through the hoops a couple of times but at the end of the day, I think that it does come out consistent across the jurisdictions. We apologize for putting it before you a

number of times. It would perhaps make your life simpler by sticking to the substance that was on the first pass.

QUESTION [INAUDIBLE]

JOHN FITZGERALD

That is a long question with a long preamble. The original process was established before the board came into being. It was entirely consistent with the EARP process that applied then. I do not think that there is any question that it has to be reviewed. The present initial evaluation for the construction site is not a requirement of the board, it is a step which is being taken more as insurance against a procedural possibility than anything else. Nobody believes that the change in the construction site is going to be anything materially different than the site that was previously under consideration. However, because of the Rafferty/Alameda decisions and the Oldman River decisions, the decision was taken that this process should be honoured in case somebody—after all the agreements were in place and the proponents had let some contracts—came with a court action and said, "Listen, federal government, you are putting some money into this site through the offshore development fund. Did you follow the EARP process? Show us how you did it." Again, this is the process as opposed to substance, but the proponent is preparing a statement that will be used by the federal Minister's department in making his decision. The Minister has to determine that there are no significant environmental effects arising from this project or if there are some, they can be mitigated with known technology and the plan to mitigate them is in place. If he can do that, he can make the decision honouring the EARP process without requiring a public review. It is with this process that the initial environmental evaluation process has now been, late in the day, initiated. But it was for insurance, and it is as a result of the adverse decisions in the Rafferty/Alameda and Oldman River cases. As for other situations which might give rise to further reviews, we can not see any at this point. If we could, we would take the steps to get them in train right now, but we do not see anything that could give rise to such a situation at this time.

AL LYMER

Thank you John. I am sorry but I am going to have to cut off questions now. These gentlemen have all indicated to me that they are available tonight to answer questions. I was going to say that for some incentive, maybe a libation or whatever, they will answer your questions at length.

Just to conclude, I would like to read very briefly a statement by a very famous individual, "Author Unknown."

"A man knocked at the heavenly gate, his face was scarred and old
He stood before the man of fate, for admission to the fold.
"What have you done," St. Peter asked, "to gain admission here?"
"I've been a servant of governments, sir," he said, "for many, many a year."
The pearly gates swung open wide, St. Peter touched the bell.
"Come in and choose your harp," St. Peter said, "you've had your share of Hell."

"Bringing it to Market" is the theme of this workshop. We have gone through the "Regulatory Environment" and are leaning towards meeting our direction and goal in the "Bringing it to Market." Glenn Yungblut provided comments on the federal regulatory process and COGLA's leadership in complex engineering matters. Graham Nicholls talked about the movement in the north to manage their own affairs. Fred Weir talked about the Nova Scotian board and its policy direction with major emphasis in the public review process. John Fitzgerald talked about the Newfoundland board and the operating procedures it follows. Terry Sewell talked about the Yukon's view, which promotes stability in decision-making, and told a not too bad joke about a monastery.

Please join me in thanking these people for coming and sharing their wisdom with us.

SESSION V

OIL SPILL PREVENTION & RESPONSE

PART I: INDUSTRY INITIATIVES

SHERROLD MOORE:

Welcome to this morning's session, "Oil Spill Prevention & Response." We are going to do it in two parts this morning. The first part has three speakers talking about industry initiatives. The second part, which will start after the coffee break, has four speakers dealing with the government role and the public view point.

The procedure this morning will follow yesterday's pattern. I will introduce each speaker prior to his talk. We will have questions after all the speakers are finished, so you should be preparing your notes and getting your questions ready for discussion at the end of Part 1, and then Part 2. And would the questioners please stand and give their name and affiliation.

Everyone looks very relaxed this morning. The only people who have ties are the speakers.

Up to this point in the conference we have heard a great deal about oil and gas potential in Canada's frontier areas. We have also heard about the strong interest on the part of industry, government and the public in developing and bringing this potential to an awaiting market place. During the last session of yesterday afternoon, the regulatory mechanisms for ensuring orderly development were also discussed.

The question remains, then, "Why, with all this interest, potential and expertise isn't this country a little closer to frontier production of oil and gas?" One answer has to be the legitimate demand of all Canadians that Canada's oceans and frontier lands be protected and maintained for future generations.

Of paramount concern is the issue of oil spills. Recent events in Alaska, the north coast of the United States and along the west coast of North America have provided vivid and harsh reminders of the ecological and economical repercussions that can result from major oil spills in marine waters. As a result of these incidents, government, public and industry concerns about existing capabilities for responding to and dealing with oil spills rose tremendously. Consequently, over the past year, industry and governments in both Canada and the US initiated a series of comprehensive reviews—both internally and publicly—to evaluate their respective capabilities for dealing with major spills. It is not our task today to review the reviews or to dwell on

past concerns. Rather we want to look ahead and talk about initiatives that are presently underway or will occur in the near future—initiatives that will minimize the risk of having to face another Valdez.

This morning on our panel we have representatives from industry, government and the general public. Their topic is "Oil Spill Prevention & Response."

There are a number of unique aspects of this panel. First we have both the upstream and the downstream sides of the oil and gas industry. In the past, this would not have occurred. But oil spill prevention is of such critical importance that traditional barriers can no longer exist. In the same unique sense, we have a panel member who represents the sometimes illusive, but always pivotal, general public. When you combine these interests with government representatives, I don't know if I have ever seen such a diverse representation of interests on one panel before today.

Now let us move on, and I will introduce the first speaker. Jim Swiss is the Co-ordinator, Safety, Health and Environment of the Canadian Petroleum Association. Jim is a graduate of the University of Guelph, obtaining a Bachelor of Science in marine biology in 1971, and a Master of Science in zoology in 1973. He began his career with Environment Canada in 1973, working initially within the Environment Protection Services in St. John's, Newfoundland, and then with the same organization in Halifax, Nova Scotia, from 1972 to 1982. He joined Dome Petroleum in Calgary in 1982, working in both the frontier and conventional sides of their company. In February 1989, Mr. Swiss joined the CPA in the area of Safety, Health and Environment, and in that capacity he has been involved in a wide variety of environment and safety issues. This morning Jim Swiss will speak on the implementation of the CPA/IPAC and TFOSP Task Force on Oil Spill Preparedness.

JIM SWISS

IMPLEMENTING TFOSP

Thank you, Sherrold. As you can see from my biography, I have been involved in the environmental area for almost twenty years. In all my years of involvement in this area, I have never seen the sort of concern that is being expressed daily in the papers and by the general public. I want to tell you about three incidents that have happened to me in the last six months before getting into my prepared presentation.

About six months ago, I had a chance to hear Dr. Kenneth Hare from the University of Toronto give a presentation on global warming. I thought that this was going a fairly interesting evening with about 200 or so people in attendance. The presentation was at the Jubilee Auditorium. I went up there and it was obvious that someone had made a mistake, because they had obviously booked Dr. Hare at the same time as a rock concert. The parking lot was full and there were people everywhere. When I got inside, I discovered that all those

people, probably over 1000, were there to hear Kenneth Hare. I was amazed by the turnout. A couple of months later, I was asked to do a closing address at a conference on environmental auditing sponsored by the Banff Centre. I had in my mind fifteen or twenty people sitting around the table talking about environmental auditing, and I then would get up and summarize their discussions. When I got to the meeting, there were not 15 or 20 people, there were 200 people. Again, I was amazed by the number of people who were interested in that topic.

Finally, last week I went to see my daughter's play at school. It was called "Rana's Pond." Rana in Latin means "frog". So I thought this was going to be a play about a frog pond, and I was eager to see my daughter on the stage. But the play turned out to be a major environmental statement. At the end of this play, the audience was faced with about 200 children, eight to ten years old, admonishing us and asking, "What are you going to do about protecting the environment?" You can't get away from it. So what I will to do this morning is describe what the upstream industry is doing to protect the environment from oil spills.

Although we do not want to dwell on previous history, I would like, very quickly, to give a summary of the Task Force on Oil Spill Preparedness to those who are not familiar with it. The task force was initiated in 1989 by the Canadian Petroleum Association (CPA), in response to public, government and industry concern about our capabilities for dealing with spills. In May 1989, our Board of Governors gave approval for the establishment of the task force, which was chaired by Mr. John O'Connor, President of Mobil Oil. It consisted of 11 other individuals, who were also from CPA's Board of Governors, and one from IPAC. The level of participation on this task force was very high, and all of the participants were at the CEO or President level from the various companies.

The purpose of the task force was to evaluate spill response capabilities in the upstream industry, both onshore and offshore. We were not dealing with tankers—you will hear a bit about that later when CPPI makes a presentation—and we were not dealing with spills that could be related to future production in the frontier areas. As you can see from the slide, the exercise was to be completed in November 1989, and this is the result, the completed task force report.

The purpose of the task force was to evaluate the present state of preparedness for responding to significant spills in those areas. We are not talking about the routine, everyday type of spill; we are talking about large, significant spills offshore and onshore. We wanted to provide ourselves with a feeling that the industry had the capability to respond to spills and if not, to adjust that capability. There was the objective of providing the basis for discussions with PACE, API, federal and provincial government agencies.

This is the structure of the task force. As you can see, the band at the top with the eleven companies, as I mentioned before, is the senior body in the task force. This was supported by a co-ordinating committee, which was also chaired by John O'Connor. That co-ordinating committee basically pulled the evaluation together and did most of the work. It, in turn, was supported by two working groups. An offshore evaluation group chaired by Rick Hoos, then with Amoco Canada and now with Polar Gas, and an onshore group chaired by Wayne Wiebe with Petro-Canada. First of all, these two groups established scenarios describing significant spill possibilities both onshore and offshore. Offshore, for example, we looked at the possibility of a 10 000 barrel a day blow-out at various offshore locations, and then asked the working group using the items listed in the overhead to evaluate the industry's capability for responding to that type of spill using existing equipment, infrastructure, manpower, etc. The same thing was done in the onshore evaluation. Significant scenarios were established and, because we were dealing with a large number of companies—IPAC has something in the order of 280 companies—the groups chose to survey the industry with a questionnaire. The questionnaires were sent out asking individual companies how they would respond to these significant scenarios.

The next few slides are very generalized versions of the conclusions and recommendations coming out of TFOSP. There are about 33 specific recommendations, but I have generalized here to give you a feeling of what the report said.

In the onshore areas, the task force felt that the industry is well prepared for most types of spills onto land, or into small rivers and small water bodies. There were improvements identified for areas dealing with very fast moving waters, especially during spring flood, for areas where ice is a problem during spring break-up, and for areas where spills may occur in muskeg. There were also suggestions that additional work is needed for dealing with heavy oil—just being able to recover heavy oil in the first place—and for responding to condensate spills (where the concern was one of safety in an explosive atmosphere).

I will not dwell any more on the onshore side of the business because we are here to discuss offshore concerns. I thought you would be interested in knowing what the onshore concerns were.

In terms of the offshore areas, we looked at three localities: the Beaufort Sea, offshore Newfoundland, and the Scotian Shelf. In this evaluation, the task force felt that, if a spill response were required in the Beaufort Sea, then the response would be a significant effort, but the effort would be relatively successful. This is primarily related to the very light type of oil that has been found in the Beaufort Sea. It would evaporate quickly. The sea states in that area are also conducive to the type of spill response that we would want to mount, and there is an infrastructure in the Beaufort Sea that would enable us to get equipment out to the site, because of the past operations there.

On the Scotian Shelf, there was less need for a large-scale spill response. The material that is being considered for production on the Scotian Shelf is essentially a condensate. In our experience with condensates on the east coast, if it is spilled, it evaporates very quickly. The need for a large-scale response capability, then, is lower than in other areas.

An area of concern identified in the exercise was the Grand Banks. The type of oil found there is very waxy. The sea states there are very heavy and difficult to work in and the infrastructure available for mounting a response has been reduced because of the down-turn in activity over the last four or five years.

Again, here are generalized versions of the recommendations the report. There are actually 33 specific recommendations but, in general, the report said that:

- The industry should acquire additional equipment, where necessary, and place that equipment with the major co-ops.
- The training of company personnel should be improved so that all companies have individuals within their organizations who can respond to spills, if necessary.
- Improved communications—both within the industry and between industry and government—should be improved to allow discussion of the problem areas that have been identified in some of the recent, large spills.
- Research needs to be continued into spill response technology. Canada and Canadian industry have a very good record in this area. The report suggests that we should continue our efforts and, in fact, increase them.
- Finally, in order to implement these recommendations, it is suggested that $13-15 million needs to be spent over the next five years.

All of these recommendations were presented to both the CPA and IPAC boards in November 1989, and they were endorsed unanimously by both boards. We are now entering the process of implementation.

One of the major recommendations in the report was that CPA and IPAC establish an implementation committee to ensure that the recommendations made by in the report were actually put into place and made part of industry's daily operating procedures.

This is the structure of the implementation committee. Again, because we are dealing with both onshore and offshore concerns, we decided to establish both onshore and offshore operating committees. The areas that those committees were asked to address are listed in the lower part of the slide.

To give you an idea of the range of participation on these committees, the implementation committee is chaired by Sherrold Moore of Amoco and has one other representative from CPA, Dick Stokes, President, TransMountain Pipelines. IPAC is represented by Don Barkwell, Poco Petroleum, and Bill

Anderson, Inverness Petroleum. Mr. Anderson is also Vice-Chair of IPAC this year, so you can see that they are taking this business very seriously as well. Bob Feick from IPAC and myself from CPA are the industry association co-ordinators who support the senior committee.

You can see, on the list, the range of companies and the range of people who make-up the offshore committee. Many of them are sitting in the audience. The onshore committee is chaired by Dan Claypool from Esso Resources. Again, you can see the number of companies involved in this process.

These committees were asked to come up with an implementation plan—a plan for putting into place the recommendations from the TFOSP. The items listed on this slide show the steps we wanted them to go through. First, for each recommendation, we wanted them to identify a procedure for putting that recommendation into place. What would you physically have to do to put a recommendation into place as far as the industry was concerned? We asked them to identify the responsible organization within industry that should take the lead—in determining who should be responsible for doing this—a co-op, one of the associations, individual companies. Who should take the recommendation and work with it? We also asked the committees to identify government/industry interfaces.

- Some of these recommendations require industry to sit down with government to develop new practices—and who are those interfaces?
- We wanted to know what sort of time frames the responsible organizations should use. Will this take a year to put into place? Three years? Five years?
- We wanted to know what the cost would be, obviously.
- Finally, we wanted to have some indication of monitoring. How would we know that these recommendations were actually put in place? This is a very interesting question that I will come back to because it is something that, at first, I thought was quite simple, but it becomes very complicated.

This is the schedule for the committees. As you can see, the activity started in January and we expect a final implementation plan by the end of May. To achieve this schedule we have met on a regular basis with the committees once a month for the last four months. Right now we are in the process of putting together a plan or report that will be presented in draft form to CPA and IPAC's boards at the end of May. In mid June, we will make a formal presentation to both boards seeking their endorsement of the plan.

This is the table of contents of the plan. In the last few minutes of my presentation I will concentrate on Section 2, which is an outline of how the committee wants to see some of the offshore recommendations implemented. These are divided into three areas. Again, these are generalized recommendations coming out of the report.

The first recommendation is an industrial review of the need to acquire new equipment. This is being done, in fact, through the regional co-ops—the Beaufort Sea co-op in the north and Esereau on the east coast. The co-ops are looking at the equipment that they would need to respond to the types of scenarios that were presented in the evaluation. We want this to occur by the end of 1992 at the latest. In fact, the Beaufort Sea co-op is already in the process of purchasing some of this equipment. The cost for this equipment ranges from $2 million in the North, to $4.2 million on the east coast. We also wanted the co-ops to look at the compatibility of equipment so that, if there were a need for a joint industry/government response to a spill situation, the equipment could be used by both organizations. The cost is not specified here because it is primarily an exercise in discussing the various pieces of equipment amongst the various players to see what can be down to make it compatible.

There will be two logistic studies done—one in the east coast and one in the North. These studies will look at the back-up support to identify those vessels of opportunity that could be called on to assist in a spill response.

Finally, we need an equipment inventory in the event that you were called on to respond to a major spill and did not have all the equipment yourself. With an inventory, you could quickly locate other available equipment in the country. Here, we want to do a joint effort with CPPI, and I understand that CPPI has already embarked on this exercise.

In the area of planning and prevention, we are looking at government approvals. Here, we are talking with governments ahead of time to get, at least in some cases, pre-approval for some of the major decisions that have to be made during a spill response. We are dealing with things such as dispersant approval, approval for burning and approval for disposal of oil. You know that if you are in the middle of a spill and you have to seek those approvals, there can be a tremendous time delay. If we can get at least approval in principle, if not total approval, ahead of time a lot of the groundwork would be done prior to involvement in a spill.

We see this as being a multi-tiered responsibility. Perhaps the associations or the major co-ops would set the stage by talking to government at a fairly general level, but then the individual companies and operators working in an area would have to make specific plans and agreements based on their locations. We want to begin later this year and, again, the costs have not been specifically identified because we have just started discussions with government.

We want to look at mutual support—industry/government support—that could be brought to bear in a spill situation. We are looking at what sort of reciprocal agreements could be made so there could be joint action to respond to the spill. Again, this would be accomplished by associations initially to set the framework, and then individual co-ops and companies would enter the debate.

There is an identified need to involve the public to a greater degree in spill responses. Here, we are talking primarily about public interest groups that have an interest and a concern with these situations and we feel they should be

involved. We are suggesting that we identify those organizations that have a role to play, discuss their role prior to a spill, and be prepared to use them in some capacity during spill response exercises.

A communications review was identified. It is suggested that the actual equipment and infrastructure needed for sound communications during spill response be re-evaluated. The initial response is, "We have all the communications we need because we are offshore." But you can be sure that if there were a large incident, a lot of those communications would be tied up just responding to the well problems rather than the actual spill. We wanted to take a look at what additional equipment and infrastructure were necessary to be able to mount a spill response on top of the operational response to the actual blow-out situation.

In the area of contingency planning, we wanted a set of guidelines developed through the associations for industry use. This would provide a more standardized version of what a contingency plan should look like, and what it should contain.

Finally, we wanted a directory of skilled manpower. With the Exxon Valdez, people found that it was difficult to identify who might be able to help, and who might have any expertise across North America. We wanted to start with the industry and expand to consultants in the private sector, identifying those individuals who have expertise and who may be called on to participate in a spill response. In this case, the effort is already underway. The Environmental Studies Research Fund is in the process of letting a contract to bring this sort of inventory together.

This final slide is "R&D and Training." In the area of R&D, the Implementation Committee has identified an eight point research program to address research needs for oil spills over the next two to six years. The $11.7 million is not an industry cost; it is what the committee felt would be a total cost to accomplish these eight research programs. The industry portion is in the range of $2 millio... Other groups, like ESRF, MNS and the federal government through a AMOP program, would participate jointly in some of this research. Another major recommendation is that industry should consider re-establishment of a group like the Canadian Offshore Oil Spill Research Association (COOSRA), which was active between 1980 and 1984. We are suggesting that some of the research identified should possibly be undertaken by a group such as COOSRA, although some would still be done, obviously, through the ESRF.

For training, there is a suggestion that we re-evaluate existing training programs for the Canadian industry and, where necessary, develop new types of training or new modules that can be used by the industry. Companies that are involved in the offshore could take advantage of that training to bring their level of expertise up to par.

Finally, I want to talk a bit about monitoring. Initially, I thought that this was a straightforward thing that could be put into place fairly easily. But, the first question is, "Why is there really a need for monitoring?" My viewpoint

is right now we have a nice, glossy blue report, and if we did not monitor the actual implementation of these recommendations, it would be very easy for this report to gather dust on shelves. We have to assure our Board of Governors, company members to whom we are responsible, the government and the public that these 33 recommendations are actually being put into place. It is nice to say that we have identified 33 recommendations for action, but I think we also have to say, yes, these 15 are in place now, these other five will be in place a year from now, and it will take us a few years to complete them all. If we do not do this sort of thing, the big question mark is how serious are you as an industry about improving your state of capability.

A number of models for monitoring have been suggested. My preference is to approach the organizations identified as being responsible for specific recommendations and to ask them if they have done it yet. Monitoring could take the form of a questionnaire, a yearly meeting, etc. Some participants in the Implementation Committee have commented that it would be too difficult to do that sort of monitoring and they have suggested that, perhaps, we should look at spill statistics later to see if they have improved. My personal opinion is that that is not the way to do it. We want to put in place response capability for major spills and we do not have a lot of major spills, so you cannot really judge how things are going by using statistics. The use of the monitoring results, obviously, is a way of verifying to ourselves as an industry, to government and to the public that we are serious about putting these improvements into place.

The last question here is, Where are the teeth? We have made a lot of good, solid recommendations for improvement, but the teeth are what makes it happen. Right now we have the ability to make this happen by peer pressure and moral persuasion within the industry, but I am sure that if we do not do it through those mechanisms, government will be more than happy to legislate some of these requirements. We have our work cut out for us.

In summary, I have tried to give you a thumb-nail sketch of TFOSP, what it was, what it tried to accomplish, and some of the major recommendations resulting from the exercise. I have described the Implementation Committee that is operating right now to put those recommendations into place, and I have given you a flavour of how those recommendations are being handled.

Finally, I briefly discussed some of my thoughts with regards to monitoring. When we get into the discussion period I would be very interested in hearing your opinions, especially about monitoring. This is something that will affect all companies in the industry. If you have specific opinions whether monitoring should or should not be done, or how we might approach that issue, I am sure the implementation group here would be interested in hearing your opinions.

Thank you very much.

SHERROLD MOORE:

Our next speaker is Victor Bennett, who is the Emergency Preparedness Co-ordinator for the Canadian Petroleum Products Institute (CPPI). Victor has over twenty years experience with the Canadian Coast Guard, fourteen of which are directly related to marine emergencies, spill response and cleanup. In April 1990, he joined CPPI as its Emergency Preparedness Co-ordinator. He will be responsible for developing national guidelines for the co-ordination of CPPI's oil spill prevention and spill response activities of the four major industry and marine spill co-ops.

Mr. Bennett will speak on the CPPI implementation plan and the steps that are being taken.

Will you welcome Mr. Bennett.

VICTOR BENNETT
CPPI/PACE Implementation

Thank you Sherrold. Good morning. Before I get into my overview of the implementation plan that we have in place for CPPI, I will give you a brief run-down of what CPPI is all about.

Early in 1989, the CPPI was established, basically as a federation of the five associations—Atlantic, Quebec, Ontario, Canada West and petroleum associations. Since that initial decision, the board of CPPI has indicated that these associations, by the end of this calendar year, will become divisions of CPPI with a vice-president reporting to the president in Ottawa. The 12 member companies represent the vast majority of the petroleum refining and marketing industry in Canada. These companies employ approximately 30 000 people directly and, of course, thousands more indirectly. We operate 26 refineries which process an average of 1.3 million barrels of crude oil per day and transport petroleum products via road, rail, pipeline and water.

Those 12 members represent Chevron Canada Limited, Esso, Husky, McColl Frontenac, Mohawk, Petro Canada, Polysar, Shell Canada, Sunoco, Turbo Resources, Ultramar, and the United Farmers of Alberta Co-op. In essence, that is CPPI. We have a major undertaking ahead of us, and we hope to represent the downstream portion of the industry with one voice, which is now centred in Ottawa.

We are very confident of the implementation plan, as put forward by the CPPI submission. It has a lot of potential and we are being very pro-active. We want to be seen as doing something before the release of Brander Smith's report; we want to do things on our own without having to be told by others.

In November, CPPI announced that $40 million has been committed to the expansion of existing marine spill co-ops and the establishment of two new co-ops. The two co-ops that exist presently are Burrard Clean, centred in Vancouver, and Pimmeck, which is centred in Sarnia. These two co-ops now

have full time managers who represent them at all stages. The two new co-ops that we are presently putting into place will be centred somewhere in the corridor of the Quebec—Montreal—St. Lawrence area and the Halifax harbour. We call the Halifax co-op the Atlantic one right now, because we are not sure what its real name will to be. Right now, we want to take baby steps first and look at just the Halifax harbour area; we are not yet thinking of looking at all the Atlantic coast.

In Vancouver, the Burrard Clean Oil Spill Co-op represents capital expenditure of $3.9 million and estimated expenditures over the next three years of $6.1 million. In the Atlantic region and the St. Lawrence region, the organizing committees have put together their basic criteria for response requirements. We are looking at spending approximately $3 million in 1991 for the Atlantic area, and a total expenditure of $6 million over three years. The St. Lawrence co-op, basically has the same figures.

The existing co-op at Pimmeck will be expanded. We hope to spend approximately $2 million dollars there, and $4-6 million over three years. So there is some commitment to increasing our response capabilities and making sure that we are capable of meeting the requirements.

From a dollars and cents point of view, this is what CPPI members are willing to put into place.

These are other aspects of the implementation plan. CPPI, in its presentation to Mr. Brander Smith, indicated that we wanted to put together an emergency response co-ordinating committee. This co-ordinating committee would have as a role statement, "To co-ordinate the efforts of all member companies to ensure effective and consistent national emergency prevention response capabilities." This sounds like a lot, and it is a lot. We have put together eight working groups to deal with those issues.

The emergency response co-ordinating committee reports directly to the Board. I am responsible for providing the support and the co-ordination for the eight working groups. We have asked those eight working groups to supply an action plan with its financial implications. The working groups are: a group that will deal specifically with tankers and barges; another that deals with legal aspects and the necessary conventions that are in place; a training working group; a contingency plan working group; a response capability working group; oil spill R&D; equipment inventory; and the co-operatives. As you can see, all the member companies and their volunteers will be working very hard to meet the necessary roles and responsibilities given to each working group.

The implementation task force was put together to deal quickly and specifically with key issues. As co-chairmen, Harvey Fryers, who is the chairman of the emergency response co-ordinating committee (ERCC), and I act as a filter to decide whether an issue should go up to the Board or whether it can be resolved at the member company level through ERCC. Basically, the task force lasted for only two meetings. It was kind of nice to see a committee come and go rather than seeing work going on forever.

The working groups have already had one meeting. The roles and responsibilities, as I have already said, have been outlined. Each member company has identified a volunteer who will participate in the working group, and we have also identified the key individuals who will act as leaders. Their first task was to establish their priorities and present an action plan as quickly as possible.

CPPI is very committed to convincing government leaders and member companies to put together a co-ordinating committee on marine spills. This co-ordinating committee will be a consultative group to provide some sort of effective and efficient forum for decision-makers in industry and in government. I agree with Jim that unless we take the initiative, it is going to be pushed on us. The Coast Guard and other organizations have been very receptive to this. The other industry representatives that were at the first meeting were the CPPI, Canadian Chemical Producers Association, Canadian Ship Owner Association, Shipping Federation of Canada, the Council of Marine Carriers, Chamber of Commerce of British Columbia, and others as appropriate (we are not sure who the others are right now, but as the key issues come up, they will be called upon).

Initially, CPPI requested that the Coast Guard share this co-ordinating committee, but it has been decided that we will co-chair. I think this leads to a more effective partnership and better communication, and it allows for a more equal sharing of the work load. However, CPPI will lead on behalf of the down-stream members.

We see the co-ordinating committee as a non-operational committee. Basically, we want it to establish criteria and possibly broad guidelines that industry members, as well as government, should strive towards. Various areas could be: contingency planning, training, response guidelines, R&D co-ordination, and, of course, other issues that come forward.

The next step is a computerized inventory system. I am sure many of you may remember the O'Neil system. O'Neil was a gem in its time, but it outgrew its usefulness. However, CPPI is committed to putting in place an inventory system that will be useful to both member companies, associate members and any other organization that wishes to have access to it, such as government agencies. We had a workshop April 26, 1990. We brought in approximately 20 different people from industry and government and hired a facilitator who is a leader in the field of inventory systems and GIS systems. In this workshop we concluded that two types of inventory systems are required, and that they can't be put together in a short time frame. So, we put together a working group to look at both of these requirements. The group is supposed to get back to us within a month with some sort of action plan on how it will deal with these conclusions.

The working groups are going to look at: What is required from an operational point of view? When a major incident or problem occurs, what is it that you need to have on hand immediately? Many of the operators indicated that going to the computer is not the answer because the computer does not move equipment. Going to a custodian of the equipment, who knows where it

is, is a much better approach to take. It is not a wasted step. So we have to rethink that. I think the basic premise is accurate. We need an inventory, but it should not be a step in the response mode. The second aspect, of course, is the inventory system that is required for contingency planning and getting "our act together." We need data on the location of sensitive areas, the flora and fauna, and we need to have an adequate data base in the system so that an operator, when he is going through his planning and contingency planning, can pull out those inventory bases. It allows him to do some better planning.

The workshop, as I said, was a success and we will be getting more information from industry people in the very near future.

We have put together a very pro-active communications plan. One part deals with Mr. Brander Smith and his inquiry. As a matter of fact, principals of CPPI will be meeting with Mr. Brander Smith today to reiterate the statements in our submission and also, perhaps, to understand the rationale he is using and the different approaches he is taking in response to these submissions. This will be the third meeting we have had with him in the last month and a half. I guess there is still some leeway in his writing if he still wants to have these meetings.

We want to make sure that CPPI keeps a high profile in the media, and that member companies are well represented. Appropriate press releases will be issued wherever possible to maintain that interest. We had press conferences on March 21 and March 25, 1990 to announce the new co-operatives in the Atlantic region and the Montreal-Quebec corridor. We will follow up the St. Lawrence corridor press release on May 31, 1990, when we will have a major press release. We plan to announce the co-op's initiation in Montreal in the morning, in Quebec in the afternoon. We will hold a dinner for the VIPs that evening so we can get down to brass tacks about what the co-ops can and cannot do. So, it will be a very aggressive press conference and media release. We plan on doing the same thing for the Halifax co-op when it is ready.

In essence, this is the CPPI implementation plan. Since I just started in April, a lot of the action plan has not been finalized or even accepted by the president. However, I hope to establish very active liaison with other organizations, and the CPPI secretariat and the staff officers hope that we can offer as much assistance as possible.

Thank you.

SHERROLD MOORE:

Thank you very much, Victor.

Our next speaker is Lyn Arscot, General Manager of Health, Environment and Loss Prevention with Chevron Corporation in San Francisco. Lyn holds a Bachelor of Science and a Doctorate in mining engineering from the University of Nottingham, England. During 1962-1964, he was British Commonwealth Scholar, studying exploration geophysics in India.

Prior assignments with Chevron/Gulf Oil Company were Assistant General Manager—producing western region, Technical Manager with the central division, General Manager of Production for the Houston district, and he was also Production Manager in New Orleans, Lafayette, Monahans, and Bakersfield in California.

Before his production management assignments, he was Director of Energy Research at Gulf's research facility in Pittsburgh, where he had held numerous positions in production technology. He was the 1988 President of the International Society of Petroleum Engineers, which has a worldwide membership of 51 000.

He and his wife, Joan, live with their two children in San Francisco.

Lyn Arscott with speak on the API initiatives in the United States. Would you welcome Lyn Arscot.

LYN ARSCOTT
Chevron, USA

API INITIATIVES (US)

Good morning. Thank you, Sherrold, and thank you for the invitation to be here representing the lower 48, south of the border. I bring you greetings from my home state of California, sometimes called the cereal state—the land of the fruits and the nuts and the flakes. People there ask, "Why do most politicians and lawyers live in Washington, D.C. and all the weirdos live in San Francisco?" The answer is: "San Francisco got first choice." That only applies to American politicians, I want you to know. There does have to be something in those nuts and flakes, though, because they did win the Super Bowl, and the World Series opened in San Francisco, as you know, so they have to be doing something right. The joke going around San Francisco after the Super Bowl was, "What's the difference between the Denver Broncos and Cheerios?" The answer is, "Well, Cheerios really belong in a bowl." At this point, there is usually someone from Denver in the audience who throws something.

I am indeed pleased to be here to tell you about what we are doing. I have been very interested, yesterday and today, to see what is happening up here in Canada. I think it is very important we have a partnership.

This industry operates by commission of the public. I think we have to get this into our heads. It is very important and good to see that you have these stakeholders here—members of the public, not many, but a few. At least we are not preaching to the choirs as we generally do. We have regulators here and we have industry people here.

The Valdez incident cost Exxon $2 billion, but as you know, the repercussions in this industry are enormous. I do not know of any one single incident that has caused this much effort in the industry, except, maybe something like an OPEC embargo.

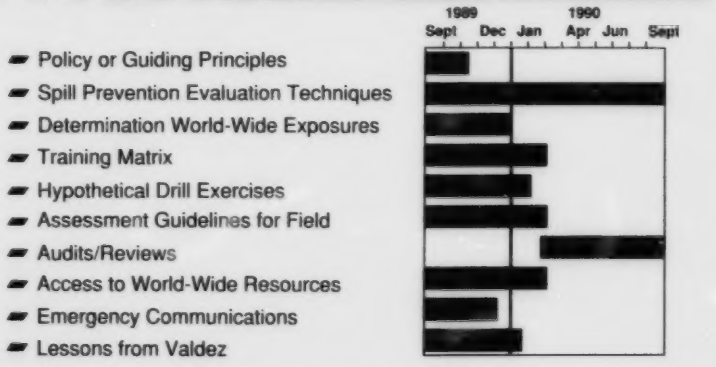
We have a field off Santa Barbara, California—Point Arguello. The partners have $2 billion invested in the offshore platforms and the onshore facilities. That $2 billion has been sitting for two years waiting for a permit to operate. Right now we are hung up on the tanker permit and, I think, if it were not for the Valdez incident, we would have had it by now. This is an example that whatever happens to anybody in this industry will affect the rest. Public polls are going very strongly against the oil industry. In fact, recent opinion polls showed that 80 per cent of Americans thought that the environment should be preserved even at some economic costs. There is overwhelming support for protecting the environment, and we found public opinion in favour of offshore drilling is decreasing considerably—mainly because of this lack of credibility. So, we have to do something about it.

I would like to tell you what has happened since Valdez. There are three levels of effort. The first level is what a major company like Chevron has done. Chevron represents a number of the other majors in the US. The second is what has happened at the co-op level, and the third is what is happening at the API level.

After Valdez, Chevron set up more than twelve task forces to look at our worldwide problems concerning oil and chemical spills. We had about eight people working on these task forces. It was a massive effort, covering every part of our operation: shipping, refining, production, pipeline, public affairs, research, insurance, finance, etc. Every part of the operation was investigated in some detail. This summarizes some of the results.

First, we had to worry about policy and guiding principles. When you have a big corporation with lots of companies, you have to be very clear which company does what. When a ship pulls up to a refinery, who is responsible for what? We had to spell that out. The spill prevention and evaluation techniques were applied specifically to things like shipping, vessels, offshore production, marine transportation.

Specific Deliverables



i. **Worldwide Exposures:** When you operate worldwide, clearly, you have specific risks and problems.

ii. **Training**: You cannot do enough training, so we had to increase our efforts, with, for example, hypothetical drills.

iii. **Assessment Guidelines:** Nameplate capacities of equipment usually apply to good conditions. If you have bad weather, for example, the nameplate capacities do not mean very much. So we had to train people on exactly how to assess the capability of their equipment and to assess the problem, depending on the type of oil conditions.

iv. **Audits Review:** This is pretty self-explanatory.

v. **Access to Worldwide Resources:** The previous speaker mentioned this, and we have assembled a resource inventory.

vi. **Communications and Lessons From Valdez:** We had a whole team which tried to look at what happened at Valdez and tell us what they thought.

Let me go through some of the things that we have come up with. The number one rule is, "Don't get the oil on the water." I mean just quit putting it there. Every time we turned around that was the obvious way—preventing it—and we found that there is a lot of ways that you can prevent it.

Oil Spill Prevention
Chevron Shipping Company

- Reroute our vessels in environmentally sensitive areas including Santa Barbara Channel and Straits of Florida
- Ship-specific spill prevention and control plans
- Extra officers or crew to reduce fatique
- Design improvements to our vessels (e.g., high level alarms, auto pilot alarms, relocate bridge equipment)
- New bridge management and cargo handling courses for our vessel officers

i. **Avoidance**: We were able to reroute some of our vessels away from environmentally sensitive areas. It reduces your risk. In Santa Barbara, instead of going through the channels, we have routed around those areas (in consultation with local public and the local officials). It costs more time and more money, but we thought it was prudent. Each ship has some specific need, depending on its equipment; it was looked at carefully.

ii. **Extra Officers** to Reduce Fatigue: We hear this time and time again. In fact, there was a spill off the east coast a while ago. The Captain had been up something like 24 or 36 hours, and the guy said he was just tired. We find that this can be a problem, particularly when docking or unloading, when it is busy for those people.

iii. **Design Improvements:** These are self-explanatory. Design improvements need to be working and people trained to use them, of course. We found that one of the weak spots in the analysis was in the interface between the ship and the dock facilities. There was a gap that was not as well covered as either two parts.

iv. **Prevention:** Some of you may be aware of the term "Process Hazards Management", sometimes called quantitative risk management. These techniques apply to any risks, and today we are trying to go beyond compliance. Compliance is a given; we will obey the letter of the law, but what we are trying to do now in the industry is reduce the risk. This process applies to risk of toxic release, a fire, a spill, and basically contains all of these pieces. When we audit we find that we changed something two years ago and never bothered to update it. You have to have that up-to-date information on your materials.

v **Process Hazard Analysis:** This is sometimes called hazard and operable ability analysis (HASOP), and it is getting to be a well defined science. Basically, it involves a team of experts who will go through every aspect of a process or procedure asking a lot of "what ifs?" The team will produce three diagrams—consequence analysis. Within Chevron we have set up a corporate co-ordinator who trains trainers, and then they go out and train other people. So, we get this expertise filtered through the whole corporation.

vi. **Management of Change**: You think about changing this or that but you do not ask what it will affect. There was a major explosion in a competitor's refinery in New Orleans. A small change in the feed water created a special sort of corrosive effect. This probably would have been overlooked, even with a good team of people, but they changed something and ended up with a major disaster.

Most of these following are self-explanatory. Airline pilots go through a rigorous pre-start checklist. How many of you go through a checklist when you are doing something in a process you have already done? The incident investigation. In the offshore production business, we look very hard at what has caused spills, where they were historically. We found the number one cause of spills in offshore facilities was corrosion and erosion. You tend to think of disastrous things like blow-outs, but, at least in Chevron and in the industry, we do not have many blow-outs. Most of the oil is from other, more common causes. The number one cause of failure of pipelines, rises, and tankers was corrosion and erosion, and we had to strengthen programs in non-destructive testing, more monitoring, corrosion cooping, sand probes, smart pigs where you can pig.

The number two cause of spills was human error. We looked into things like training and diet. When you are offshore or in the Arctic, the food is cheap and plentiful. What effect does it have on a person's concentration? The drug and alcohol policies were very strictly enforced and, going back to the shipping issue, correct staffing levels. The third major cause of oil spills is mechanical failure, other than corrosion, such as machinery pumps, etc. There was a list of about ten of these things like communication between shifts so

incoming crews are properly briefed. Other items on the list were undersized equipment, poor design, and safety device testing. There is a whole list that can come out of an inquiry like this "Process Hazards Management."

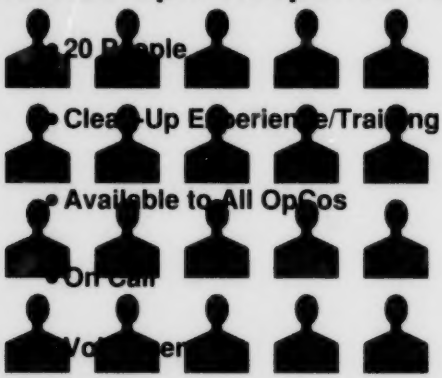
Response

Location	Chevron Action
	• Respond immediately
	• Response by terminal operator • Monitor & take action as needed
	• Respond immediately
	• Response by vessel owner • Monitor and take action as needed

Let's jump from prevention to a response. In shipping, you think it would be straightforward, but there are combinations—in this case, you have a Chevron ship at a Chevron dock and those two groups of people have to get their act together. They both have contingency plans and they know who is going to do what. But, now you have a Chevron ship at some other dock. Who does what? We have had to make sure that every place we go there is an agreement between the owner of the dock and the owner of the ship about who does what, when. Here, you have a Chevron tanker and Chevron oil in the ocean. What if it were a Chevron ship with someone else's oil? In this case, it is the vessel owner who has all the responsibility, not the cargo owner. This brings out the issue that it is not very clear who is responsible because we have interlocking arrangements and customs.

We found that, even for small spills, the resource team is instrumental: a public affairs specialist, a clean-up consultant, an ecology consultant. We will send them right away to the scene, however small. For example, we had a spill a few weeks ago at Delaware Sound, where only 10 barrels were lost. We sent a team. The spill occurred right at the mating season of the horse-shoe crabs. At that critical time thousands of birds descend on the area and all of a sudden tar balls arrived on the shore. We sent two clean-up specialists, who did a lot of work and then had to go through our public affairs person. We had a spill in the Seattle area in the river where we contained it right away. But one beaver had oil on it. We caught the beaver, sent it in for cleaning and a week later they released the beaver. This story was on television for almost the whole week. I cannot tell you how important some of these things are. So, the resource team gets there right away.

Worldwide Spill Response Team



Before Valdez, we were not tested on who the real experts were. We now have 20 experts working on-call to go anywhere in the world.

Functional Teams

Aircraft Services
Chevron Information Technology Corp.
- Communications
Comptroller's Dept. - General Services & Purchasing
HE & LP - Environmental, Industrial Hygiene, Safety, Wildlife
Human Resource Services
Law Dept.
Medical Staff
Public Affairs
Security Staff
Treasury Dept. - Insurance, Claims

- Each prepares & maintains its plan
- Plans must be flexible
  - Small to large spill
  - Worldwide

We have the functional team that will be involved in a big spill. Each one will have a contingency plan and will be trained. Aircraft services, the law department, public affairs, the purchasing and general services people—each one has a contingency plan. I think it is very important because they will be involved in anything but the smallest of spills.

We also set up the steering committee. There is a need for two of these executive committees. This one is independent of an incident; it has been controlling the activities within the corporation for prevention and response planning. You would also probably set one of these up for a major spill. But this one meets every few months just to make sure the plans are being put in place.

This gives you an idea of this worldwide problem. This is just a graphic illustration of where we have potential spills and, again, what comes out of this is interlinking associations with partners or subsidiaries. We looked at a risk analysis of the Chevron product:

- what type of product was it?
- the historical experience—have there been problems in the past?
- how busy are the shipping lanes—are they high risk?
- what would be the consequence of a spill? Do you have environmentally sensitive areas? Is it in proximity to populations drinking water, etc.?

So, a risk analysis has been done on the whole system, and we have had to prioritize it to reduce the list because, clearly, to approach it all at one time is a big effort. We set up modern communication equipment. This van has a satellite dish and we can either put it on an airplane or take the equipment out of it and put that on an airplane. It is ready to go for remote communication anywhere in the world.

Public/Government Affairs Lessons from Valdez

- Be prepared to communicate directly to the public through paid advertising
- Top-level management immediate public involvement and leadership is critical after a major crisis
- Continuity of clean-up operations personnel is essential to effective management and perceived competence
- Need contingency plan for handling claims issues
- Identify in advance possible impacts from spills in major operating areas
- Obtain pre-approvals and permits necessary for spill clean-up in advance

The lesson from Valdez: if you cannot communicate with the press very well, you might want to pay for some advertising to get your story across. The top level management must be involved and concerned. A lack of continuity in clean-up operations, the business of one team leaving and another coming on without communications, is bad. The claims will eat your lunch even for small incidents. You have to be able to manage this one.

Oil Spill Response Co-Ops

	Pre-Valdez Equipment Value	Total Capital Budget 1989 1990	Expense Budget 1990
Clean Sound (Seattle)	$ 9.0M	$13.1M	$ 1.4M
Clean Bay (San Francisco)	$ 5.5M	$ 2.9M	$ 2.8M
Clean Seas (Santa Barbara)	$20.0M	$ 1.5M	$ 5.0M
Clean Coastal Waters (Los Angeles)	$ 1.5M	$ 2.6M	$ 0.8M
Clean Gulf (New Orleans)	$12.5M	$ 3.4M	$ 3.5M

Let's switch now from what Chevron has been doing to what the co-ops have been doing. The co-ops are owned by the companies that operate in a locality. I just want to capture in this one slide some of the co-ops on the west coast. This is an approximate value of their equipment prior to Valdez. Then, in 1989-1990, what their budgeted capital expenditures are and an estimate of what their total expense budget is. Some things pop out clearly. Clean Sound in Seattle felt they needed the biggest increase. Clean Seas is special. As you can see, they had $20 million worth of equipment before. There is a permanent condition offshore Santa Barbara where two of those large vessels (they have three of them) have to be patrolling at any one time around the facility. They do a lot of training, and they are a very well-run organization. You can see the others. For example, Southampton co-op is adding about $10 million to its equipment this year.

Petroleum Industry Response Organization (PIRO) Formation

- PIRO formation recommended in June 14, 1989 report by API task force of senior oil company executives
- Steering committee representing 6 oil companies
- Established company called PIRO Implementation, Inc. funded by 20 oil companies
- Steering committee made recommendations in January, 1990

PIRO: As in Canada, the executives met right after Valdez. On June 14, they issued a report that was to establish a network of response organizations in the US. In order to do that they had to go into a design phase. They set up a steering committee comprised of six oil companies and about 20 or more committees with more than 100 people to go into the detail of the design of this response organization. They established a company called PIRO

Implementation Inc. (PII), which was funded by 20 companies. They have actually reported since January 1990. Before we kick off the implementation, we are waiting for legislation from Washington, which we think is imminent. Right now we have a president and a staff of three to five.

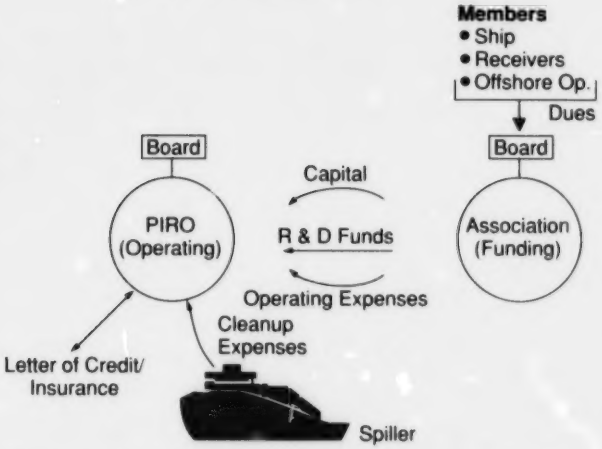
Estimated PIRO Participation

Member	% of Industry
Chevron	11.3
Exxon	7.6
Amerada Hess	7.6
Texaco/Star	7.4
Shell	6.3
Arco	4.6
BP America	4.2
Amoco	3.5
Mobil	3.4
Marathon	3.3
Sun	3.0
Phillips	2.1
Conoco	1.7
Unocal	1.7
Lyondell	1.6
Ashland	1.6
American Petrofina	1.0
Kerr-McGee	0.9
Pacific Resources	0.8
Muphy	0.3
	73.8

This is a list of the twenty companies that formed the PII. There is an estimate of the per cent of water-borne oil that these companies have—so that is a breakdown of what the budget will be. Chevron appears to handle the most water-borne oil, so we will get the biggest chunk of that. We calculated those numbers for facilities and offshore production.

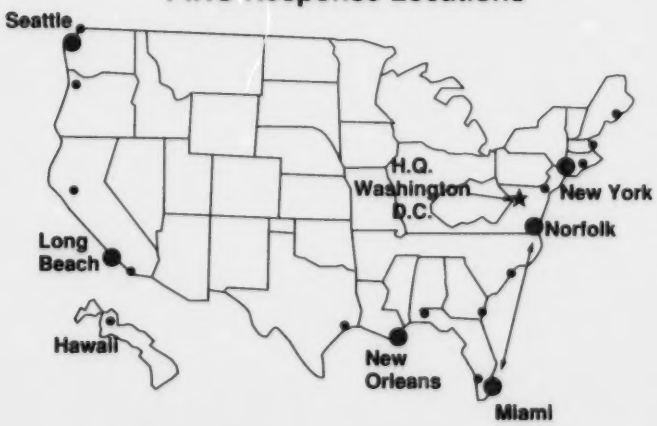
The legislation will require contingency plans for offshore operators and facilities and demand two things: the ability to pay for spills, which means you will have to have insurance; and the ability to respond. If it is anything over what the local co-operative can handle, the legislation forces you into belonging to PIRO, if you are going to operate or deliver oil to the US. This is set up by lawyers, and driven by liability.

Corporate Structure



There are two boards, two companies, and we want to separate the problems of the spiller and his liability from all of these operators who are voluntarily establishing PIRO. You will hear the term "the good samaritan protection". It is a critical issue in Washington—if this fellow gets into trouble, you do not want him dragging all these deep pockets because, when you have a catastrophic spill, someone is going to be injured, someone is going to be mad and they are going to be looking for someone to sue. Therefore, the lawyers have come up with a board or a company where, if you belong to PIRO, that is where you belong and you will pay your dues to the funding association. They, in turn, will provide capital, research and development funds and expenses to maintain the capability of the operations. If there is a lot of money being spent by a spiller, they are not going to spend that money, the spiller has to spend it or it has to be federalized—and we have a fund set up at $.05 per barrel which will add up to about $1 billion.

PIRO Response Locations



But, you want to protect all his problems, or these guys from his problem, and if PIRO needs operating money, it will get a letter of credit, etc. In being involved in the design of PIRO, the lawyers tend to dominate in more than their technical contribution, which is unfortunate but it is a necessity in this age. They are going to set up five major response centres, with a headquarters in Washington, and about 19 staging areas. Response centres will be manned and they will conduct the business in their region. The staging areas will be like storage yards—skimmers, booms, etc. The final decision for their exact placement has not been made and discussions are still taking place. These are the basic recommendations. In responding to catastrophic spills, it is very important that they do not compete with the co-operatives—co-operatives are critical and the majority of spills will be handled by a co-op. Anything larger than a 200 000 barrel spill will be handled by a PIRO response centre. Total staffing is 300 people in the five response centres. The first year costs are almost $100 million, and the total over five years will be over $400 million.

PIRO Major Recommendations from Steering Committee

- Main objective of PIRO: Respond to catastrophic spills beyond the capability of local oil spill cooperatives
- Establish Washington, DC headquarters and five regional response centers
- 19 equipment staging areas to support the regional response centers
- 216,000 Bbl. oil spill response capability for each response center
- Total staffing of about 300 people
- First-year cost of $97MM and $75MM cost each succeeding year. Five year total cost of about $400MM
- Coast Guard should coordinate and direct response to large spills beyond local response capability
- 5-year R & D program

The steering committee recommends that the Coast Guard co-ordinate and direct the major spills. The Coast Guard can just monitor the smaller ones, as long as the spiller is responsible or the local co-op is there. But the industry would like them to take a more active role in the bigger spills for two reasons: first, it triggers the good samaritan immunity or protection under the impending federal legislation; second, it is very important that one agency co-ordinates the multitude of government (federal and state) agencies. They did establish a five year research and development program. The two major areas are on water recovering treatment and the shoreline impact. There is about $30-35 million in the R&D budget over five years, covering things like dispersants, booms, skimmers, jells, absorbents, tracking, bioremediation, in situ burning, etc.

PIRO Research Program

Objective	Budget $K
• Preventing Loss From/Away From Ship	750
• On-Water Oil Recovery and Treatment	10,850
• Preventing & Mitigating Shoreline Impact	11,925
• Fate & Effects of Oil in the Environment	7,500
• Mitigate Impact on Wildlife	1,850
• Health & Safety Issues	750
	33,625 ($30-35MM)

Oil Spill Liability and Compensation Act

	House	Senate
Good Samaritan Protection for Responder	Immune if Directed by President	No Mention
Response	Vessels and Facilities to have Contingency Plan Must List Response Equip. and Personnel	Same but Without Federal Equip.
Double Hulls/Bottoms	All New Construction Existing ships 7-15 yrs	New Construction Within 1 Year Unless Study Shows Safety Not Enhanced

Note: 30 states currently reviewing legislation

In this last slide, I will summarize the very critical legislation in Washington right now. The House has voted on a bill; the Senate has voted on a bill, and now they have to have a conference so there is one bill, and that is where they were last week. It is important in the industry to have this good samaritan protection. The House bill says it is in, and hopefully the Senate will go along with that because it is important to the industry. Vessels and facilities must have a contingency plan which effectively forces people to join PIRO; otherwise, responsible companies will fund something and others will have a free ride. A big issue is the double hulls double bottoms. The House bill says all new construction and existing ships have 7-15 years to get modified. The Senate wants to see new construction within the year. But there is an important study by the National Academy of Science, which is looking at the risk of double

hulls double bottoms and problems of flooding the annular chamber or getting explosive gases in that chamber. The Senate understood that if some evidence were presented from these studies, it would make it questionable whether they should mandate these double hulls double bottoms. Another important factor is that 30 states have their own oil spill legislation. Some want to establish their own funds. We have a $1 billion fund nationwide. California wants $500 million.

Let me conclude by saying that the industry must increase its credibility. We have a lot of activity going on in both Canada and the US. We have to do this by superior performance. I encourage you to be diligent and take it seriously. Good luck to you and thank you very much.

SHERROLD MOORE:

You have heard from Jim Swiss who talked about the upstream on the onshore and the offshore; you have heard from Victor Bennett who talked about the downstream; and you have just now heard from Lyn Arscott who talked about preparedness in the United States. I am sure there are a lot of questions out there.

MIKE ROBERTSON, PETRO CANADA:

Lyn, I enjoyed your presentation very much, but I wonder how you set up some kind of mechanism deciding which R&D study is to be done by the PIRO structure, and, in light of the studies that have been done in the past, [inaudible] so that when you spend the $35 million you have some tangible improvements.

LYN ARSCOTT:

This is a very important question. There are a lot of people doing research: the API and the DOI have a $6 million research program going, NOAG (National, Oceanographic, Aeronautic Group) a $35 million program, and there are university projects. It is going to be done by committees, and they will to have to talk to one another. I would assume that the Canadian counterparts are talking to their US counterparts. They are aware of it, and they are talking. I am assuming that it is the same in Canada.

VICTOR BENNETT:

Yes, we have made contact and the talking is about to start. I think we need contact with PIRO to see what is going on.

JIM SWISS:

If you look at the list that Lyn Arscott had on the board, and look at the eight point program that we identified, they are virtually identical. It would be a real shame if both groups went off in parallel without some communication.

DAN HIBBARD, AMOCO:

Jim Swiss, what is the task force doing, in terms of communication with the public, to get a positive image? We heard yesterday that it was important for industry to understand and communicate media and so forth. What are we going to have for a public front?

JIM SWISS:

I think that is a very important thing to consider. At the end of the evaluation we had a major press conference, in conjunction with CPPI. At the same time, we did a cross-country tour of various government agencies that had an interest in our spill response capability and told them what we did in terms of evaluation. Later in the implementation we have to do the same sort of thing. After we have presented our plan and received approval from our Boards, we plan to do a similar cross-country tour to government agencies. The next step is to meet with the press and let people know what we are doing. Part of the implementation procedure involves coming up with mechanisms such as newsletters and summaries that can be made available to interested parties, interested public groups.

RICK HOOS, POLAR GAS:

You threw out a challenge earlier, Jim, about thoughts on monitoring, and I think we are hearing the end of the answer already. As Jake Epp pointed out very clearly yesterday, we should be spreading the word more clearly and more regularly than we have in the past. We can do that as an end product and, presumably, the front end is that CPA needs to make sure the recommendations are being implemented. It seems to me that the best way to do that is to have the subcommittees, who put forward the recommendations and who are following through on them, be obliged to report back to the CPA Board, perhaps, every six months or so; and in turn that information should be conveyed to the government and then to the public. Perhaps there should even be an opportunity for the government to have some input into how things are going and whether, in fact, they feel it is a good thing or we are missing the boat.

JIM SWISS:

I agree with everything you said, and that is essentially the route I thought we would take. But some within the industry may feel that you are placing companies at jeopardy by identifying the fact that they had not done the amount of suggested training; or if you come out with a yearly report stating we have not done what the implementation plan has proposed, there could be difficulties. I do not know exactly how we overcome this resistance.

NORM STROM, ERCB:

Jim, could you elaborate on that point a bit because there has been a lot of talk about public involvement, and the public is everyone, not just industry and government [inaudible]. If they engage in the problem-solving, they will

buy into it. If you bring the solution to them, they have to go through the whole educational process before they buy into it.

SHERROLD MOORE:

Norm, I wonder if we could expand that to all three panel members on what is the public involvement from their upstream/downstream and US perspectives?

JIM SWISS:

I agree with what you have said, Norm. We have to have some way of providing teeth to this whole system. What we are shooting for right now is peer pressure and moral suasion to ensure that these recommendations are implemented. There was some discussion when we were putting the implementation plan together of actually involving government in some of the committees. For a variety of reasons it was decided that that would not happen, that we would do it in-house. I think it can still work that way. But I agree that government has to play an important role in ensuring that some of these things have to be put in place. In answer to your question, then, we are going to try to do it in-house.

LYN ARSCOTT:

On the PIRO operating board will be members of environmental groups and the public. I think we can take a cue from the way we are handling communities with facilities nearby. Some chemical plants or refineries that could release toxic or explosive materials have community outreach programs; and some companies are more progressive than others. But the difference between risk assessment (what an expert would calculate the risk to be), and risk perception (the nuclear industry is the best example of that) is great. Most of us in this industry are either engineers or technical people who, I don't think, have a good feeing for the psychological issue that is kicking us.

VICTOR BENNETT:

With respect to CPPI, we have asked our director of public relations to develop a list of key media contacts. We have also brought on stream a media company, which is in the process of putting together a communications plan for next year. We plan to make sure that we go out to the key interest groups, key media—especially those reporters who became very knowledgeable over the last year about oil spills. As well, the co-op managers will become full-time co-op managers, and part of their major responsibilities will be to liaise with industry groups in their immediate area and spread the word that the co-op is there to assist. The other potential form of linkage between other organizations and government is attendance at various conferences and workshops.

DAVE BOONE, ESSO:

Lyn touched on the notion that fear of liability or fear of suits can lock up a co-operative effort if it is not properly set up. Would you other gentlemen comment on the Canadian perspective, upstream and downstream. Does that affect the initiatives that you have on the table?

VICTOR BENNETT:

I know that it is affecting us right now. As a matter of fact, our lawyers are in the process of trying to figure out how we will set up our co-operatives. Right now we are using a non-profit, joint venture agreement. Our only problem was that our Burrard Clean, which is a non-profit, joint venture, came back with $1 million in its pocket last year from assisting in the Exxon Valdez spill, and we are not sure how we are going to get rid of this profit. The two new co-ops that are being put together now have a team of legal people looking at the various organizations and methods that could be put into place for either a joint venture and at whether we should incorporate the co-op, and make it stand alone. Very clearly we are concerned about the linkage, if I may go back to the comment of deep pockets, and we have a team working on that now. The Burrard Clean co-op will stand on its own for at least another year or so; however, the other three co-ops will be brought into the fold as soon as we have some agreement in place.

JIM SWISS:

We have had similar considerations, mostly on the onshore side of our business. We have a major co-op called PROSCARAC, which presently functions as a committee of CPA. We have considered spinning off PROSCARAC to make it a separate corporate body reporting to CPA. In doing this, we sought a legal opinion on what that would mean in terms of liability. The answer was that we would basically set up a hurdle in front of people seeking to approach the deep pockets. But it would not provide much protection once that hurdle was cleared. They would be back at the associations and the industries supporting the associations. It is a major concern and not one that is easily resolved.

LYN ARSCOTT:

In Canada is there any good samaritan regulation or protection?

SHERROLD MOORE:

No, at least not that I am aware of.

QUESTION:

It occurs to me that the 200 people here, and those thousands within in the industry, are all expected to be experts. It does not matter where you work, our friends and neighbours are going to ask us questions if anything happens. I

do not know if the Tory Cabinet or the Amoco managers really know what happened after the spill, what the truth of the matter was in terms of the effect on the environment. I wonder whether there is any method by which we could use propaganda, if you like, within our own industry to provide the truth to us all.

SHERROLD MOORE:

I am not sure that there is a very good answer. Speaking for Amoco though, that was a technical problem with the propeller. The resolution was in the court [inaudible]. The clean-up was done and I think things are back to normal. That was some years ago. Other than that I do not think I can help you.

QUESTION:

The impact that you have pointed out at Valdez has been enormous. Will we ever know the effects?

SHERROLD MOORE:

Well, I think we have a fairly good understanding of the impact and that is what is happening here this morning. These kinds of meetings, at least from my side, are going on all over North America. There are public perception and public awareness; we are all aware that the public is very much involved in this whole thing of preparedness and protecting the environment. In Canada, we have just gone through Earth Week, and we have Environment Week in June and the same sort of thing is happening in the US. These are permanent; they are not going to go away. The people in the oil and gas industry have to be prepared and have to be "Johnny on the spot."

RICK HOOS:

If I could just add to the latest concern that was raised about the question of information and communication. In all these incidents where the story is in the news, or even in the on-going Valdez situation, extensive research programs were conducted both immediately and afterwards and these have been very thoroughly reported in the scientific literature and in the greater part of industry and the government. However, time and time again we run into the problem that the average person on the street does not know about the existence of all that information and the many text books and reports available conveying that information. Unfortunately, the only information that the public seems to remember is what is on the front pages of the newspapers and what is splashed over the television screens. Again, good communication about what we have done right and, also, about what we have done wrong and what we have tried to learn about it, is very important.

VICTOR BENNETT:

I want to reiterate what Rick just said. We have the information that you are asking for. There are meetings held every year among oil spill experts, the federal government, API, but in those meetings we are basically talking to

the converted. I think it goes back to the challenge that Jake Epp gave us yesterday and, also a year ago at the CPA annual dinner. We have to take that information, put it into a consumable form and present that information to the general public. Rick is right because what the general public sees is what the media wants them to see on the nightly news—the sea otters, the dead birds. But, there is another side to these stories, and some of these incidents have more positive endings than the media would like us to believe.

SHERROLD MOORE:

So we do not take too much time away from the second half of this session, I am going to have to cut the questions off.

Would you join me in thanking our three panel members.

SESSION V

OIL SPILL PREVENTION AND RESPONSE

PART II: THE GOVERNMENT ROLE AND THE PUBLIC VIEWPOINT

SHERROLD MOORE:

Part II of our discussions this morning is the "Government Role and the Public Viewpoint." Our first speaker is Michael Turner, who is the Deputy Commissioner of the Canadian Coast Guard. He was born in Alberta and raised in Winnipeg. Mr. Turner joined the federal government after graduating from the University of Manitoba in electronic engineering. He later joined the Canadian Coast Guard's Halifax office, and after 12 years in various technical and management positions, moved to Ottawa in 1983 with his wife and two children. In 1988 he was appointed Deputy Commissioner of the Coast Guard—the position he currently holds today.

Mr. Turner is going to speak on the federal role.

MICHAEL A.H. TURNER
Deputy Commissioner, Canadian Coast Guard

OILSPILL PREVENTION AND RESPONSE IN THE MARINE ENVIRONMENT:

A CANADIAN COAST GUARD PERSPECTIVE

This topic is a challenge in itself, and I will attempt to focus my remarks on the marine aspects and shipping in particular.

In the aftermath of the Exxon Valdez disaster, the governments of both the United States and Canada, as well as several American states and the province of British Columbia, undertook reviews of their preparedness to deal with major oil or chemical spills from ships. In Canada, the federal government initiated an internal review, and established a Public Review Panel on Tanker Safety and Marine Spills Response Capability.

I will begin with a brief overview of responsibilities for management of marine spills within the federal government, and a short background on the present efforts of the Canadian Coast Guard to ensure navigation safety and thus to protect against spills. I will then quickly review Canada's present spill response capability. The results of the work of the internal review process will

then be highlighted, with an indication of some areas requiring improvement. I will stress the need for a co-operative approach among industry, government and special interest groups to work towards a more effective response community for dealing quickly and effectively with marine spills of all sizes.

As we are all painfully aware, much has changed over the past year in terms of public, industry and government attitudes to protection of the environment. Perhaps nowhere is this more true than in the case of the transport of large quantities of oil and chemicals, particularly by sea. Since the marine transportation of crude oil and petroleum products is an essential part of our modern industrialized society, Canada's ability to ensure the safe passage of oil and chemical tank ships and to respond effectively in the event of a significant spill, has been at the forefront of these concerns.

Most of you will no doubt be aware that marine navigation is wholly a federal responsibility, and federal services related to safety of navigation and the regulation of shipping are largely provided through the Canadian Coast Guard of Transport Canada. Thus, after the dramatic events surrounding the Exxon Valdez grounding, and the Government's decision to establish both a comprehensive internal review and a Public Review Panel of Tanker Safety and Marine Spills Response Capability, many of us in the Coast Guard, along with a number of other departments and agencies, have spent much of the past fifteen months preoccupied with this topic.

Those of you associated primarily with the downstream aspects of the industry and whose companies rely on Canadian or foreign flag tankers for either the import of crude or the movement of product between Canadian ports will have been directly touched by these efforts. You may have been following closely the work of our internal review team and the Public Review Panel led by David Brander-Smith, Q.C. Certainly, your industry associations, both the CPA and the newly formed Canadian Petroleum Products Institute, have been very directly involved and your contributions to this national effort are very much appreciated.

FEDERAL DIVISION OF RESPONSIBILITIES:

Of course, things are rarely as simple in the real world as we would all like, and this axiom certainly applies to the interface between the federal government and the petroleum industries. In the case of land-based upstream exploration and production activities, regulation and monitoring are normally provided by the provincial governments. But it is the federal level, or federal/provincial levels in co-operation, which controls the offshore. Those of you from companies with offshore exploration experience will, therefore, be well aware that it is the Canadian Oil and Gas Lands Administration (COGLA) that is the dominant federal government player on Canada Lands, including those under the oceans off our coasts, along with the Newfoundland (CNOPB) and Nova Scotia (CNSOPB) joint management boards for waters adjacent to those provinces. These agencies, in turn, have co-operative arrangements with the Canadian Coast Guard, which carries out on their behalf the necessary inspections of mobile offshore drill rigs for issuance of the required safety

certification. In the rare case where the offshore rig is of Canadian registry, and thus a "ship" under the laws of Canada, this certificate is issued directly by Coast Guard, rather than by us on behalf of COGLA, or CNOPB, or CNSOPB.

Turning to areas of responsibility within the federal government for marine spills, all of the applicable legislation is based on the "polluter pays" principle, and the onus is generally on the polluter (in fact on the ship, as a legal entity, in the case of a ship-source spill) to respond to the incident without delay. Consistent with the federal government's policy relating to emergency management, the Coast Guard, as the agency with primary statutory authority concerning ships and related marine matters, is also charged with "lead agency" responsibility for response to ship-source pollution, while other departments such as Environment Canada, or Fisheries and Oceans, provide valuable support as "resource agencies." As "lead agency" we must ensure that the polluter responds immediately and efficiently; otherwise, we are authorized to do so ourselves at the polluter's cost. The general supervision and government inspection of such an operation by the polluter or his contractor would fall to the Coast Guard. It is our Minister along with, increasingly, the Minister of Environment, who is called to account in Parliament and the press for the success (or otherwise) of the response.

Should a spill originate from an operating drill rig or production platform, or from a tanker loading at such a facility, COGLA/CNOPB/CNSOPB would act as "lead agency", and Coast Guard, along with other agencies, would provide support, although the polluter would still be responsible. And just to complicate matters a bit more, in the case of "mystery spills" (i.e., source unknown) into a body of water, it is the respective federal and provincial departments of environment that are responsible for ensuring an adequate response, though they often rely on Coast Guard as "resource agency" in the areas in which we operate. Of course, every rule must also have an exception, so Coast Guard is "lead agency" for mystery spills in the Great Lakes, under the Canada/US Great Lakes Water Quality Agreement.

Fortunately, these distinctions are not usually a problem for those in the industry, since inter-agency co-operation on marine spills management is usually very close.

THE PRESENT SITUATION IN BRIEF:

With the internal review of Tanker Safety and Spills Response virtually complete, and the Public Review Panel now expected to report in about a month, this is a good opportunity to step back briefly and examine what we have learned, and where Canada stands in relation to other nations in this area.

Since first becoming heavily involved in spill response and management in the early 1970s, after the ARROW incident in Chedabucto Bay, Nova Scotia, Coast Guard has developed an organizational structure and has built up the necessary logistical infrastructure to permit a rapid federal response to marine spills. This infrastructure includes the setting up of a series of

emergency response equipment depots across Canada, the development of national and regional marine emergency contingency plans, as well as a joint Canada/US contingency plan and a joint government/industry agreement. It requires the training and designating of on-scene commanders and pollution countermeasures equipment operators, and the holding of regular exercises with other federal and provincial agencies, as well as elements of Canadian industry. The structure, which has evolved over the years, includes a major role and responsibility for the experts of the federal Department of Environment (DOE), as well as for the Department of Fisheries and Oceans (DFO) and, increasingly, the provincial departments of environment. Through the Regional Environmental Emergencies Team (REET), chaired by the senior DOE representative on-scene, Coast Guard's on-scene commander is provided with timely and detailed advice on environmental concerns and priorities including most effective methods of cleanup to minimize environmental damage, slick trajectory projections, fish habitat concerns, and waste disposal alternatives.

Unlike the American situation, where there is a fairly sizable response industry, Canada has had to rely more heavily on developing that kind of capability through the government. We now have some 50 equipment depots across all regions of Canada, including the Arctic, with about $34 million invested in response equipment. Although about 50 people are permanently employed in equipment maintenance, exercise preparation and contingency planning, several hundred of our regular staff in other programs, including ships' officers and crews, are trained to fulfil major roles in the event of a major incident.

Supported by the environmental technologies staff of DOE, particularly in the case of R&D, we have examined and tested nearly every significant piece of cleanup equipment available on the world market. We have concentrated our acquisitions, however, on equipment that is most effective in inshore waters, where the vast majority of incidents occur.

Nor have we been inactive in the area of spill prevention. Indeed, the safety of shipping, and thus prevention of accidents of all types, has always been our primary mission, and absorbs the vast majority of our resources. Canada's domestic standards for tanker design, construction, manning, operation and maintenance have been among the strictest in the world. While Canada remains highly dependent on foreign flag shipping for all of our import and export trade, not just in oil and petrochemicals, Coast Guard has developed and implemented systems such as vessel traffic management and electronic aids to navigation designed to ensure safe passage for all ships. Increasingly, we are also looking "behind" the certificates issued by other maritime administrations by boarding and inspecting foreign flag ships entering Canadian ports to ensure they meet international convention standards. Indeed, our present policy requires the boarding and inspection of every foreign flag tanker entering Canada at least once a year, on its first visit, under our "Port State Control" program.

THE RESULTS TO DATE:

Canada has enjoyed, historically speaking, a relatively good record in terms of significant marine spills. Our modern response capability is certainly on a par with that of most modern nations, but our review has identified a number of areas requiring improvement. Some of these are essentially policy or statutory updating with little or no direct cost, while others could have significant cost implications, for both government and industry. Of course, it should also be noted that until the Brander-Smith Panel report is issued, and Ministers have had the opportunity to consider its recommendations, there will not be any final decisions on the areas to proceed with their relative priorities. Nonetheless, this short paper will attempt to provide a brief overview of our work to date.

Clearly, after 16 years of operating with the provisions of the Canada Shipping Act (CSA) Part XX (recently amended as Part XV and XVI), the time has come for some updating and revision. As the law now stands, the financial onus is on the shipowner in the event of a spill, while the Act is silent on who actually has the responsibility for response. No specific provision is made for government oversight of cleanup, though it is implied. There are also inconsistencies that need to be addressed in the areas of liability and compensation for damages between southern waters and those of the Canadian Arctic.

During the last round of amendments to the CSA we received the necessary authority to allow Canada to ratify the International Convention for the Prevention of Marine Pollution from Ships, usually referred to as "MARPOL 73/78." We are now preparing the necessary Canadian regulations, and barring unforeseen problems, expect to have these in place by the end of the current year. As Canadian shipowners generally meet the MARPOL requirements already, any burden as a result of these regulations should be minimal. However, we are now giving serious consideration to regulating tank barges concerning pollution prevention standards. While we will be carefully considering the extent to which existing US standards can be adopted for this largely west coast industry, there is clearly the potential for a significant impact on some operators in terms of cost for new construction and retrofit.

As many of you will be aware, the issue of whether double bottoms or double hulls should be required for oil tankers, rather than just for chemical carriers, has also received considerable attention in the media. Canada must work closely with other nations concerning any changes to international standards rather than adopt unilateral action. It is highly likely, then, that the actions already underway in the US Congress will set the direction in this area, requiring all tankers entering US ports after a certain date to be of double bottom construction. Clearly, this will force the hand of ship builders and operators world-wide. However, in our case, we must also consider whether such rules should be implemented for all domestic vessels currently operating on the Great Lakes and on Arctic waters off Canada.

No matter what changes in standards eventually come about, you can expect to see stepped up enforcement action by Coast Guard, particularly with regard to foreign flag ships. Our Port State Control program, referred to earlier, will be increased, and plans are underway to increase our aerial surveillance capability to detect and prosecute those who continue to despoil our shores and kill our wildlife through illegal bilge pumping.

Turning to the preparedness side of the equation, our contingency planning needs improvement in a number of areas, and our on-scene commanders would certainly benefit from improved scientific support in areas such as airborne spill tracking, pre-spill environmental sensitivity mapping, spill debris disposal techniques, and data on spill occurrences and spill fate. In many of these areas, we look to our colleagues in the federal Department of Environment or Department of Fisheries and Oceans for help and support. Similarly, there is a need to reactivate the inventory of computerized pollution countermeasures equipment in order to have a better handle on what capability exists, not just within government, but across all organizations and industries nationally and internationally, before a major spill occurs.

Concerning our collective national capability to respond to oil and chemical spills in the marine environment, a number of areas have been identified, and work is already underway on improving the existing systems. Independent consultants have been used to conduct a spills risk analysis to assist us in better planning and pre-positioning of equipment. A similar independent review has looked at our own (Coast Guard) response capability. This review found that our capability in the inshore and for sheltered waters was in reasonably good shape, but that our capability to recover oil at sea in the offshore environment is extremely limited. Obviously, this is not news, as we all realize that existing technologies are very limited in their capabilities to recover oil in the open ocean. To develop such a capability, especially in view of the limited risk, would be extremely expensive, and may not be justified except in exceptional cases, notwithstanding the high expectations of the general public.

Certainly, one exception worth noting would be in the case of offshore exploration and development, where, I expect, government will be looking to the industry to provide a local response capability in keeping with the degree of risk and the environmental sensitivity of the surrounding waters, similar to existing practices in the North Sea.

It is also clear that Canada has a very limited capability to handle hazardous chemical spills in the marine environment, and we intend to work closely with the chemical industry, local ports, DOE and others to build up such a marine HAZMAT capability within the Canadian Coast Guard.

Until this past year, marine pollution response, particularly in coastal areas, has been left almost entirely to the federal level of government. Now, however, we are seeing increasing interest and concern on the part of several coastal provinces, with some wishing to participate directly in shoreline cleanup, and apparently prepared to invest in the necessary equipment and

training. British Columbia has co-operated with a number of American states to review spill response, and it has commissioned independent assessments of what additional preventive measures might be appropriate. The province is now seeking consultation with the federal level on which of their recommendations we are prepared to adopt. Considerable discussion will be needed over the coming year to integrate effectively such efforts into the overall spill response plans. Similarly, we are now faced with growing numbers of volunteers wanting to play a more direct role, and ways must be found to integrate such groups into the overall response plan, perhaps in areas such as wildlife rescue and bird cleaning.

Perhaps most important, however, is the need to work closely with the Canadian petroleum industry, as well as with provinces, ports and volunteer groups, towards a new response model, which is based on a sharing of responsibility to enhance our collective national capability in this important area of environmental protection.

WHERE TO FROM HERE?:

In the course of our work, a number of themes have emerged, but at the same time we are still faced with serious constraints. The Coast Guard is under strong public pressure to respond immediately and fully to every pollution report received, despite our reduced resources and significant competing priorities. We see pressures to have Coast Guard invest heavily in additional offshore response capability, even though experts agree that such operations are often not very effective, and even though the federal government's financial capacity to make such investments at present is seriously constrained.

Understandably, we see concerns that a multiplicity of agencies, each with its own legitimate areas of concern, can lead to confusion and delay in response; yet the world is not a simple place, and each organization has its own responsibilities. Improved co-ordination and co-operation will certainly be necessary as we move into the future.

At the same time, we in government see the Canadian petroleum industry showing a growing awareness of its responsibilities, and demonstrating more willingness to be part of the solution, instead of part of the problem. Significant sums of money have already been committed by the companies and organizations represented at this conference to enhanced response capability in areas of heavy marine movements of crude and refined products.

Perhaps of greatest concern, no matter what improvements we collectively put in place, is that the public's expectations as to what we should be able to accomplish after a spill are extremely high, and probably unrealistic.

TOWARDS A NEW PARTNERSHIP:

In our view, what is needed to deal effectively with these often conflicting issues could best be termed a "New Partnership". The federal government, Canadian industry, the provinces, port authorities and concerned volunteer groups will need to sit down together and work out how the high level of readiness and response capability, which the Canadian public is demanding, can best be met within our limited resources as a nation.

Work has already begun in this direction, with discussions underway among the Canadian Petroleum Products Institute, as sponsor of the industry oil spill response co-ops, Coast Guard, DOE, COGLA, and a number of other federal organizations, as well as industry organizations representing the shipping fraternity and chemical producers.

At this stage, it is too early to reach conclusions as to what this "New Partnership" will look like, and we have yet to hear from the Public Review Panel, which will most certainly have a number of significant recommendations in this area. Discussions to date focus on a "response model", which would see the industry co-ops and port management accept greater responsibility for all spills within their area of operations, up to a pre-determined size or difficulty, before calling in the Coast Guard. However, Coast Guard, along with agencies such as DOE and DFO, would continue to oversee the operations on behalf of the Government, and in the case of significant incidents would be prepared to step in to assume direct control and to ensure the necessary resources are brought to bear on the problem.

Outside such pre-agreed areas, we would see the co-ops being available on a contract basis to support and extend our own capability or that of the shipowner. When a major spill occurs, we remain convinced that some form of comprehensive joint government/industry oil spill response plan should be available to ensure a full and adequate response to pollution incidents.

At the final level, in the event of a catastrophic incident like the Exxon Valdez, Canada will need to rely on an international network of governments, agencies and companies able to assist on short notice. Indeed, we are already actively involved in the negotiation of a new international spill response co-operation treaty under the aegis of the International Maritime Organization (IMO) of the United Nations to ensure that such provisions are in place in advance of another catastrophic spill, no matter where it may occur.

Other variations on this general approach are also available, of course. As one variation, the CPPI Co-ops would have a wider role and mandate to respond to spills, with Coast Guard as the federal on-scene co-ordinator; in another variation, a revised federal structure such as a multi-department National Response Team could be set up and trained for response to all spills beyond those handled by the co-ops in their local areas. Whichever approach is eventually agreed on, it is clear that there is room for improvement in our existing arrangements and in our collective national capability to deal with marine spills, and an open, productive dialogue among all concerned parties is essential to the success of this process.

IN CONCLUSION:

As noted earlier, marine spill prevention and response has been under the microscope over the past fifteen months, and the process of improvement, renewal and collective search for solutions is not made any easier by the public's high expectations in this area. There are no easy answers, nor simple solutions, to this complex twentieth century problem. What is clear, however, is that the process has stimulated a lot of creative thinking amongst a wide group of interests that might best be referred to now as "the response community," and that the public expects change.

We look forward to continuing to work closely with Canadian industry, shipowners, other agencies and departments of the federal and provincial governments, and the growing number of special interest groups within the general public, as we search for solutions. Our objective remains unchanged: to have an oil spill response capability in Canada that involves all concerned parties; that is commensurate with the degree of risk; and that is comparable to the best capability of similar nations with like risk. Only by working together can we achieve this goal.

SHERROLD MOORE:

Thank you, Michael. Our next speaker is Dr. Vera Lafferty who is Director General of the Environmental Protection Branch of the Canada Oil and Gas Lands Administration (COGLA) and is the Vice-Chairman of the Environmental Studies Research Fund (ESRF). She has worked in the Geological Survey of Canada, in the International Union of Geological Sciences and for the Auditor-General of Canada in the areas of policy, international relations, communications and program management. Prior to joining the federal public service, she lectured at McGill and McMaster Universities in Russian literature and civilization.

Dr. Lafferty will speak on "The Future of Research and Development—ESRF." Would you welcome Dr. Lafferty.

VERA LAFFERTY
Director General
Environmental Protection Branch

ESRF: FUTURE DIRECTIONS IN OIL SPILL RESEARCH AND DEVELOPMENT

Flying to Calgary en route to this meeting, my neighbour in the next seat turned out to be a CTV producer off to China on special assignment. We chatted. He asked me where I was going and why. When I told him about the workshop we had held on oil spill research needs and future directions, he said: "Why are you talking in Fairmont? Why not in Toronto, to the media?" Now it wasn't until the Minister's message yesterday (and his theme was repeated by many of the speakers that followed), about the need to talk more about the good

jobs we do environmentally, that I began to appreciate fully the pertinence of the CTV producer's comments. Mind you, I'm not so sure about holding meetings in Toronto versus Fairmont Hot Springs!

Ladies and gentlemen, I have one of those good stories to tell about oil spills. I will be giving you an overview of the results of an oil spill research workshop that we commissioned recently on behalf of the ESRF Management Board.

The ESRF, for those who are not all too familiar with it, is the acronym for Environmental Studies Research Funds. It is a research program financed by special levies on the oil and gas industry. It is managed jointly by a government/industry/public Board; the chairman is Michael Robertson of Petro-Canada. It is administered by a secretariat housed in the Environmental Protection Branch of COGLA.

ESRF research studies are intended to provide industry and government with state-of-the-art information—data and information to help them conduct environmentally sound exploration and development on frontier lands. Of the over $16 million spent on studies since the start of the ESRF in 1983, almost a quarter has been spent on oil spill research and countermeasures. In fact, the ESRF secretariat has just produced a small brochure highlighting this work; it is available at this workshop, along with lists of titles of ESRF published reports.

When the ESRF Board met last August (in the thick of the various national, federal, regional and industry reviews of tanker safety and oil spill preparedness), the Board was a bit shy about charging into more oil spill research without guidance from acknowledged scientific experts. What, we asked, was the best "fit" for ESRF, given the existing body of knowledge and data? Moreover, could the ESRF contribute meaningfully to the many other research initiatives underway in Canada, in the US and elsewhere?

In the aftermath of Exxon Valdez and the unprecedented public, media and political attention given to the risks of oil spills, we were all sensitive to the need for a practical and demonstrable commitment by both government and industry. But there was also the recognition that resources were limited, and had to be focused on the greatest need, the maximum benefit.

We resolved to sponsor an expert "brainstorming session": bring together the top oil spill minds from across Canada, along with one or two from abroad. A few of these people are here today. The workshop took place in Ottawa in March and the comprehensive report, prepared by Dr. Sy Ross (of S.L. Ross Environmental Research Ltd.), workshop convenor and orchestrator, was just submitted to the ESRF Board last week. Let me summarize the key results.

The focus throughout was on research requirements to improve the state-of-the-art for responding to and controlling major marine spills—spills from tankers and from offshore drilling activities. Five areas or themes were highlighted for attention from the outset:

- oil spill containment and recovery equipment
- dispersants and other treating agents
- in situ burning and disposal
- surveillance, tracking and modelling
- shoreline clean-up and restoration

I will be skimming through only the main high-priority proposals that emerged, by consensus, from some fairly intense discussions of each of these areas.

A total of 16 R&D projects were proposed under the theme of containment, recovery equipment and operations. The highest priority, in terms of need, was assigned to the following:

i. Develop standard test criteria for skimmers. What is needed is a standardized evaluation process and reporting format to focus on criteria such as recovery rate and efficiency. This recommendation addresses the problem that standard criteria are not available for testing devices, and uncertainty exists over the relative merits of various devices—problems that affect contingency planning and equipment procurement.

ii. Undertake comprehensive testing of skimmers, i.e., the logical "second step". Without this, the oil spill response community is left with performance data that are a mix of manufacturers' claims, non-standardized experimental data and anecdotal information.

iii. Similarly, develop standard test criteria for pumps; and undertake comprehensive testing of pumps. The situation with transfer pumps and transfer systems is analogous to that of skimmers with respect to performance claims.

iv .Investigate the relationship between boom performance and boom design and configuration.

v. Evaluate the use of special-purpose skimming vessels. These have apparently been put in service recently in Germany, the Netherlands and the USSR. What is being proposed is an evaluation of their overall response capability and applicability to the Canadian scene.

vi. Improve recovery of high viscosity products, which is ongoing research. However, recent spills of highly viscous fuel oils and crude oils that rapidly emulsify have reinforced the need for skimmers that can process large volumes of viscous product.

vii. Improve the recovery of oil in ice, which is ongoing research, particularly in Norway. Several devices, still at the prototype stage, were highlighted as being ripe for evaluation.

viii. Investigate occupational health and safety concerns. Countermeasures activities often include operators and vessels that have primary functions other than spill response. This recommendation addresses the safety of personnel on supply vessels, explosion hazards of recovered oil, etc.

Under the theme of oil spill dispersants and other treating agents, 16 more research projects were delineated. I will talk about the three key ones.

i. Not surprisingly, developing more effective dispersants was high on this list. What was envisioned here was a major international "joint venture" involving chemists from major oil companies, detergent manufacturers, universities and government laboratories. Though risky and costly and long-term, this was seen as a potentially significant solution to the fact that existing products are largely ineffective on the range of oils likely to be spilled in Canada.

ii. Second, develop protocols and analytical tools for field effectiveness trials—to measure more reliably dispersants effectiveness.

iii. Third, field test emulsion inhibitors and emulsion breakers. Recent research has indicated that certain chemicals can be applied to marine oil spills to inhibit the oil's tendency to form viscous water-in-oil emulsions ("mousse") and even to break emulsions. Further examination, evaluation and refining, however, will be required.

The discussion of burning, an effective countermeasure for oil on the ice and among ice floes, produced 13 project ideas, while another eight related to other forms of oil spill disposal. Highest on the in situ burning priority list were such recommendations as:

i. Conduct large-scale offshore burning trials using fire-proof/fire-resistant booms. Such tests are now being organized by the US Minerals Management Service, DOE, and the National Institute of Standards and Technology. These tests are using fresh oils in relatively calm conditions. Further "non-ideal" offshore trials will be required to evaluate ignition devices, test methods for residue recovery, etc.

ii. As follow-up to this, develop protocols and procedures for conducting in situ burning safely and effectively under different conditions.

iii .Investigate the effect of waves and currents on in situ burning, and how they affect the efficiency of the combustion process.

iv. Investigate novel methods to enhance the combustion of oil spills. Air injection and the use of steelwool heat-transfer promoters were cited as examples.

v. Investigate in situ burning of oil on mud flats.

vi. Develop regulatory public information programs on in situ burning. Though not, strictly speaking, R&D, the consensus was that this constituted an urgent priority.

With respect to disposal systems in general, workshop participants agreed that existing know-how and technologies were sufficient to develop an effective overall disposal system, but that:

i. Specifications should be developed first, based on data collected from recent significant spills.

ii. Emissions testing should be conducted in spill disposal kilns, incinerators and flares under a range of operating conditions.

iii. Better, higher capacity flare burner systems for oil spill disposal offshore should be developed.

iv. Pre-packaged pitliners for temporary storage should be designed and developed.

v. A review of large-scale municipal/industrial waste management, solids handling and other systems should be undertaken to see what could be usefully applied to the problem of oil material disposal at major spills.

In discussing potential research in the area of surveillance, tracking and modelling, an urgent priority was placed on the need to:

i. Develop improved methods for displaying or presenting spill tracking data collected by remote sensing aircraft. This project offers not only practical application but some commercial potential as well.

ii. Develop better methods for measuring oil dispersion through sonar techniques.

iii. Investigate the behaviour of oil in broken ice in the presence of wind.

iv. Develop systems for measuring oil slick thickness. A major R&D program supported jointly by the US Minerals Management Service, DOE, and Esso Resources Canada is apparently now underway to develop such remote sensing systems.

v. Investigate the use of CODAR, which is a device for measuring surface currents from a remote land-based location, for oil spill surveillance/trajectory modelling.

Under the shoreline clean-up and restoration theme, there were again a healthy number of proposals, including:

i. Improve oil spill contingency planning for shoreline clean-up i.e., improve the overall state of preparedness.

ii. Review, screen and test biotechnology/biodegradation techniques.

iii. Enhance the transfer of existing knowledge to operational personnel. This addresses the fact that there are no systematic programs in Canada as yet.

iv. Conduct field evaluations of selected clean-up techniques for pebble-cobble beaches (mixed sediment beaches)—a common shoreline type in Canada. This points to deficiencies in existing clean-up and disposal capabilities. I understand that some initial studies for such work have been completed by DOE, and other feasibility studies are in progress.

Well, it is quite a "shopping list" one might say! Let me add that this group was not short on ideas: what I have uncovered is just the "tip of the iceberg." There are 77 research proposals in all. If implemented, they would culminate in millions of dollars of expenditures.

By virtue of the timeliness of this effort, and the calibre of the collective brainpower that generated it, we have a potential blueprint for future research directions for a number of research sponsors, not only ESRF. And there is much research underway or being planned.

We heard about industry's concerted efforts in this area this morning; research is a key component in these efforts. There are several ongoing government research programs. PERD (the Panel on Energy Research and Development), government-wide, government funded, managed by Energy, Mines and Resources Canada, is also geared up for oil spill related studies. We have the research data still emanating from the Exxon Valdez tragedy. Lyn Arscott talked about PIRO (the US Petroleum Industry Response Organization) which is also developing research projects. And so on.

Clearly, one of the biggest challenges facing any research sponsor considering these recommendations is effective, ongoing co-ordination, to ensure that there is no duplication of effort or "re-inventing of wheels."

When the ESRF Board meets again over the next two days and discusses this report, I suspect we will find the issue of selectivity equally problematic. Canada's coastal terrains present a pretty challenging set of variables. Should the research priorities that have been outlined be sifted further on the basis of where most of the activity is likely to occur in the near future?

Costs, too, are prohibitive. Few projects remain that will give good return for a one-time investment of, say, $50 000. These types of studies have largely been done. Should we not, therefore, be looking now at buying into multi-disciplinary, multi-year, comprehensive research projects and programs, i.e., research "joint-ventures"?

These and other planning and implementation issues face the ESRF Board in the days ahead. But the fact remains that they now have the considered opinions of a broad cross-section of industry, government, and consulting researchers and scientists to guide them. They have a report that is reasonable, forthright, pragmatic. The groundwork has been laid.

Thank you.

SHERROLD MOORE:

Thank you very much, Dr. Lafferty. Our next speaker is David Thorton, director of the River Road Environmental Technology Centre, Conservation and Protection, Environment Canada. David obtained his Bachelor of Science, first class honours, in physics in 1966, and his PhD, in theoretical physics, in 1969. He is also a post-doctoral fellow.

Mr. Thorton was Research Manager for Environment Canada in 1975, Chief of the Research Division for the Environmental Emergencies Branch in 1980, and was appointed to his present position of Director of the River Road Environmental Technology Centre in 1983. He is also part-time special assistant to the co-ordinator of the preparedness response team, Federal Marine Spills Review 1989-1990.

Mr. Thorton will speak on "The Arctic and Marine Oilspill Program."

DAVID E. THORNTON, DIRECTOR
River Road Environmental Technology Centre
Environment Canada

AMOP—THE ARCTIC AND MARINE OILSPILL PROGRAM

1. INTRODUCTION:

This paper summarizes the work done and currently in progress under the Arctic and Marine Oilspill Program, more commonly known as AMOP. The program began in April 1977 with an initial focus on the southern Beaufort Sea. Studies triggered by an oil industry proposal to undertake offshore exploratory drilling there had concluded that few proven countermeasures were available to deal with a blowout or any large oil spill in arctic waters. The AMOP is still an active program, and its primary objective is still to improve the knowledge base and technology for combatting arctic and marine oil spills.

The funding for the first two years was $1 685 000 and $1 805 000 respectively. The allocation for the third year (1979) was reduced to $835 000 as part of an overall government restraint program, and it remained essentially constant at that level for the next few years. Since April 1986, the AMOP funding has been allowed to vary according to the priorities of the remaining needs in competition with those for chemical spill countermeasures. The budget for 1989-1990 was $1 244 000, including $665 000 provided by the US

Minerals Management Service (MMS) for joint projects. As of 1 April 1990, the 13-year total expenditure for the AMOP is about $22 000 000, of which approximately $8 000 000 has been contributed by industry, the US MMS and others for specific co-operative undertakings such as the Baffin Island Oil Spill (BIOS) experiment and the sea trials of treating agents and oil booms which were performed on Canada's east coast in 1987.

Many papers have been published in the proceedings of the annual AMOP Technical Seminar, in the quarterly Spill Technology Newsletter published by Environment Canada, and elsewhere; and over 150 reports have been produced covering the more than 70 separate studies that have been completed. The Environmental Emergencies Technology Division (EETD) of Canada's Federal Department of Environment (Environment Canada) is responsible for the overall management and direction of the AMOP, but joint projects are managed and directed by representatives of the funding agencies involved.

The remainder of this paper will describe some of the achievements of the AMOP under each of the following main headings: Detection and Tracking; Properties, Behaviour and Modelling; Remedial Measures and Chemical Treating Agents. It will also identify some of the things that are planned for the coming year.

2. DETECTION AND TRACKING:

Because of the remoteness of much of Canada's coastal areas from population centres and potential operating bases and the added complications of ice and darkness in the Arctic, a considerable effort has been expended to evaluate and develop equipment to locate, identify and track oil spilled at sea. The following are some of the results:

2.1 Tracking Buoys:

One of the first devices to be developed was the slick-tracking buoy by Orion Electronics Ltd. in Nova Scotia. Sea trials of this floating battery-powered radio transponder have shown that its drift closely approximates that of oil.

2.2 Remote Sensing:

More than $400 000 has been spent on remote sensing, which has given us a good understanding of the strengths and weaknesses of the various techniques available, including the use of satellite imagery. Each has its limitations, and a recommended outfit includes a side-looking radar, an infrared-ultraviolet line scanner, a laser fluorosensor, an annotated colour camera and onboard realtime display equipment. The last item did not exist when the AMOP began, and the first one was developed as a joint AMOP undertaking with the Canada Centre for Remote Sensing, Energy Mines and Resources.

A major joint undertaking was a six-year project with Esso Resources Canada Ltd., to investigate the use of acoustic and radio-frequency technology for detecting oil encapsulated in ice. The radio-frequency work was terminated after a series of theoretical studies had shown little or no potential for success. However, the acoustic studies have produced prototype hardware that has performed quite well in field tests. Because of problems experienced using a commercially available towed fluorometer, EETD has built a prototype system of its own that has performed well.

Another remote sensing project was an evaluation of sensors to detect chronic oil losses from offshore platforms. The contract funding was provided by the Northern Oil and Gas Action Program (NOGAP) of the Canadian Department of Indian Affairs and Northern Development. None of the several instruments tested was able to satisfy the requirement but one, the Wright and Wright Infrared Oil Film Monitor, was deemed to have the potential to function adequately if further development could make it suitable for operational use. This instrument has since been improved, and is available commercially.

3. PROPERTIES, BEHAVIOR AND MODELLING:

A prerequisite for the development of effective countermeasures for arctic oil spills is a sufficient knowledge of the conditions under which they must work and the effect those conditions have on the properties and behaviour of the oil. The acquisition of that knowledge has proven to be a major and ongoing task that has so far consumed about $9 000 000, almost half of the total amount that has been spent on the AMOP.

3.1 The Baffin Island Oil Spill (BIOS) Experiment:

The almost $7 000 000 BIOS experiment was by far the largest component of the properties and behaviour work. This four year international co-operative undertaking by government and industry has provided previously unavailable data on the short and long-term fate and effects of crude oil stranded on an arctic shoreline, compared to that of the same type of oil when chemically dispersed in the near-shore arctic environment. Data on the effectiveness of selected shoreline cleanup techniques have also been acquired, in addition to the increased knowledge about the physical, chemical and biological processes operating in common arctic marine ecosystems.

The results provide no major ecological reasons to prohibit the use of dispersants on oil slicks in nearshore areas similar to the experimental site. They also provide no major ecological reasons for the cleanup of oil stranded on arctic shorelines, except where:

i. wildlife is present; or

ii. their critical habitat is threatened; or

iii. it is in areas of human use.

A further six years of follow-up work has expanded the knowledge of the long-term fate of stranded oil in arctic environments compared to that in a temperate situation.

3.2 Subsea Blowouts:

The basis for a series of AMOP studies came from Canadian Marine Drilling Ltd's preliminary feasibility studies of subsea containment concepts, which were followed by the attempt to capture escaping oil with the "Sombrero" subsea collection device during the 1979 Ixtoc blowout in the Gulf of Mexico. AMOP was also a minor contributor to a 1/4 scale plume and collector experiment performed by Professor J. Milgrim of the Massachusetts Institute of Technology for the US MMS and the Office of Naval Research at Bugg Spring, Florida in April 1982. That involvement proved to be the catalyst for the strong and continuing MMS-Environment Canada co-operative program that has evolved since then.

The AMOP studies have shown that it is technically feasible to capture escaping oil near the seabed if conditions are sufficiently favourable. However, because of the very low probability that such conditions will exist and the very high cost of having a system available, EETD does not consider subsea containment to be a practical countermeasure.

There has been AMOP-supported research at the University of Calgary to studied whether the oil from a sub-sea blowout is amenable to countermeasures at the sea surface. It was thought that the size of the seabed opening might control oil droplet size and be the determining factor for the formation of a coherent slick instead of discrete globules. The research has indicated that orifice size does not significantly affect the oil droplet size distribution, nor the nature of the blowout plume.

3.3 Ice Influence:

Various AMOP studies costing a total of almost $900 000 have examined the influence of ice on the physical fate and behaviour of oil and gas. These studies include, in part, compiling available information on ice type and ice extent into an arctic atlas through theoretical analysis, the determination of ice dynamics from satellite imagery, experiments in laboratories and test tanks, and field experiments involving the release of oil in ice-covered waters.

One of the important discoveries was the fact that, contrary to expectations, oil deposited under stationary multi-year ice can migrate to the surface and be so widely dispersed by natural processes that it is non-detectable after five melt periods. Another discovery was that lead closure rates are rarely high enough to force oil onto the ice surface where it might be amenable to removal. Normally leads either freeze over, in which case any oil present will be trapped within the ice, or the closure rate is so slow that oil will be forced under the ice and become equally inaccessible.

3.4 Photo-oxidation:

Apart from a small study by Professor H.D. Gesser at the University of Manitoba, which looked at ways to enhance the degradation of oil by ultraviolet light, the effect of photo-oxidation on spilled oil behaviour has not been a sufficient priority to be pursued further until recently. In the course of seeking a better understanding of the factors influencing oil dispersion, it became apparent that one of the keys might be the change in natural surfactant content resulting from photo-oxidation. That aspect is currently being explored in EETD's laboratory. Important preliminary observations include the following, for reasons as yet unknown:

i. there is considerable variation in the susceptibility of oils to photo-oxidation;

ii. heavy oils that do photo-oxidize form a skin that flakes off and the flakes sink in synthetic seawater; and

iii. there is a noticeable increase in the water-soluble component of those oils that photo-oxidize.

3.5 Oil Catalogue:

In this brief overview of some of the highlights of the work done under the AMOP on the physical fate and behaviour of oil, another item deserves mention. It is the compilation of a catalogue of the properties of oils that could be spilled in Canada or adjacent waters. The Canadian oil industry has supported the project by providing data and representative samples of frontier oils as they are discovered, common pipeline blends, imported cargoes and various products. The catalogue combines the data from industry and others with experimental data obtained in EETD's laboratory. That facility is uniquely equipped for such work because of the specialized equipment assembled during the past six years and the availability of walk-in, temperature-controlled chambers where properties can be measured at low temperatures. Data on the dispersion and emulsion-forming characteristics of the oil are presented, and the most recent version of the catalogue was produced in 1989. Like most of EETD's publications, copies are free, but we retain the right to limit quantities at our discretion.

4. REMEDIAL MEASURES:

Environment Canada has been working to improve spill countermeasures for 18 years. It was decided early on to focus attention on the problems peculiar to cold climate operations and to make maximum use of technology developed elsewhere for spills. Environment Canada also decided to tackle the essentially ice-free and complete ice-cover situations first, and to defer the problem of removing oil under intermediate conditions.

4.1 Arctic Oil Skimmers:

Prior to the AMOP, the majority of the effort was devoted to performance evaluations of remedial measures either in enclosures set up adjacent to wharves or in open water. That work had shown that three types of skimmers being manufactured in Canada were potentially effective under near-freezing conditions but all required modification to correct problems. Initially, the AMOP sought to develop and prove the necessary modifications of each type and to derive an arctic oil recovery vehicle on that basis. However, after having looked at platform options including hovercraft, it was concluded that special-purpose skimming vessels able to operate safely in the Arctic at reasonable distances from the few and widely separated support bases were possible but too costly. Work on that option was abandoned in favour of devices that could be deployed from offshore support ships or other vessels like barges.

By far the most successful skimmer development was done in co-operation with Morris Industries Ltd. of Vancouver. Based on cold-room tests at the National Research Council in Vancouver and a series of tank-tests, including some at the US Environmental Protection Agency's Oil and Hazardous Materials Simulated Environment Test Tank (OHMSETT) in New Jersey, improvements made to their oleophilic-disk models transformed the Morris products into industry leaders worldwide.

Prototypes of arctic variants of the Bennett/Versatile oleophilic belt skimmer and Oil Mop Pollution Control's rope mop were built and tested. The former was tested in the OHMSETT, and then trials were done with oil at sea off Newfoundland with help from the Canadian Coast Guard (CCG). Shortly thereafter, it was loaned to Dome Petroleum Ltd. for a side-by-side comparison test against the Lockheed skimmer, which was originally mounted on their oil recovery barge in the Beaufort Sea. The AMOP product was clearly superior, and it was purchased and installed in place of the Lockheed model. Smaller derivatives were subsequently built and sold, but so far there has been no market for the full-sized arctic model.

After simple stability trials alongside a CCG base, the Oil Mop prototype was tested with oil in a refinery settling pond where it was confirmed that the modified rope-drive mechanism had cured the slippage problem experienced with other models. However, the CCG decided not to add it to their inventory because it was too large and cumbersome to be safely deployed from their ships at sea and there were no responses when it was declared surplus and offered for sale. Eventually it was scrapped, but not until it had performed one very useful function. Because of its similarity to the larger ARCAT II developed in the United States for use offshore Alaska, the AMOP prototype was loaned to the US Coast Guard. It was tested with blocks of ice in the OHMSETT to investigate the extent to which drifting ice might degrade performance. With 50% ice cover or less, performance was comparable to that in ice-free conditions; at higher concentrations, as had been previously indicated by smaller-scale tank-tests in Canada, the ice blocked the inlet to the skimmer.

4.2 Conventional Booms:

Nothing was done to further the development of conventional booms for several years first, because of the decision to focus on open-water situations and second, because of the substantial effort being expended by Norway and others to develop booms for offshore use. The AMOP did not venture into that aspect of oil spill countermeasures development until the CCG specifically requested a scaled-up version of the river model of the Bennett self-inflating "Zoom-Boom" to be evaluated as an open-ocean replacement for their Vikoma SeaPacks.

The end result was a 12-section boom, 366 metres long, combining the essentially similar designs of two manufacturers and packaged in a specially configured hull that could be transported by helicopter as a slung load. It could be remotely deployed while being towed by either a helicopter or a suitable work-boat. A section performed well in the OHMSETT. However, when the full length was subsequently deployed at sea off Newfoundland, in conjunction with the trials of the Bennett/Versatile arctic skimmer, the CCG decided that it was not a suitable replacement for their Vikomas.

4.3 Fireproof Booms:

Prior work at Balaena Bay (NWT) during the Beaufort Sea studies had shown that confined floating oil could be burned off in situ. Therefore, one of the first projects under the AMOP was to determine the feasibility of constructing a fireproof boom to provide the necessary confinement in the absence of sufficient ice or other natural features. A variety of materials and approaches was considered. Small-scale tests indicated that fire resistant booms were indeed feasible, but floating nets were ineffective. The AMOP's efforts to achieve a fireproof oil confinement capability were discontinued when Dome Petroleum Ltd. embarked on the development of a fireproof boom for offshore use in the Beaufort Sea.

Largely because of CCG interest, work was resumed within a few years in a parallel effort to explore a concept that might result in a lighter and cheaper product. The GemEng boom with its ceramic-protected foamed glass flotation was tested in the OHMSETT, and its ability to hold oil matched that of previously tested conventional booms. It also withstood repeated and prolonged exposure to burning crude oil with only minimal and readily repairable damage. However, in both the tank test and subsequent deployments where it was subjected to moderate wave action, it sustained unacceptable structural damage despite several design changes. Work was discontinued because of these problems and for lack of sufficient market interest.

4.4 Waterjet Barrier:

Coincident with a tanker spill off Canada's east coast in 1979, a novel approach to controlling oil on water was proposed by a Mr. D. Christie of Vancouver. The concept was to use a horizontal array of high pressure waterjets to induce an airflow (artificial wind) over the surface of the water to oppose the

movement of the oil. The concept was outlined to the other members of the OHMSETT Inter-agency Technical Committee (OITC) and it was decided that some exploratory work would be undertaken in the OHMSETT. That work showed that the airflow induced by high pressure waterjets in the proposed arrangement does effectively move oil on water. Of particular interest was this observation: the presence of waves, which have made conventional booms ineffective, had no measurable effect on the ability of the jet-induced wind to move oil.

The AMOP funded the construction of a basic prototype consisting of two opposing arrays mounted on improvised floats. It was tested on the Mackenzie River at Norman Wells, NWT, in a co-operative undertaking with Esso Resources Canada Ltd. Its performance as a deflection barrier clearly surpassed that of conventional booms. Its ability to hold oil in the containment mode in a current was at least comparable to that of conventional booms and, although time did not permit making the necessary changes on that occasion, it seemed probable that it could be made substantially better in that mode too. The fact that it could be held in position without anchors or tow vessels and manoeuvred by pressure adjustments was a major advantage. Optimum flowrate, pressure, spacing, height and other key design parameters have been determined through further experimental work in test tanks in Canada and Japan.

The improvised floats were replaced with custom-designed ones that were designed to minimize drag and make more power available for resisting current or increasing the span of the array. The boom and new floats have been tested in 1.5 knot currents with oil, and significant stability problems were encountered. The floats are currently being re-designed under a joint-project agreement with the US MMS.

Brief trials were conducted in ice in the harbour at Quebec City during a spring breakup and indicated that the barrier is not effective for separating oil from drifting ice. Its utility in shallow waters such as tidal mud-flat areas has yet to be investigated.

A preliminary assessment of the waterjet barrier as a fireproof boom has been made in an Ottawa-area test tank. Facility limitations precluded the attainment of all objectives, but it was evident that the induced wind and/or the influence of the sprayed water does significantly reduce the amount of smoke that is characteristic of oil-pool burns. Further assessments are planned as part of a joint project agreement with US MMS.

4.5 Boom Test Protocol:

The largest experimental oil spill in Canadian waters was released off Newfoundland in the late summer of 1987, in co-operation with the CCG and the US MMS. The primary purpose was to gain a realistic assessment of the capability of the CCG's booms and skimmers to function in offshore sea conditions. The containment and recovery effort was one of the most successful on record. A secondary objective was to use the opportunity to deploy booms

with oil in a pre-planned situation and to validate a protocol developed by the OITC for assessing the capability of offshore booms to contain oil without having to spill it. Such a protocol is needed because of the demonstrated limits of adequately assessing offshore booms in the confines of a test tank and the need to avoid the deliberate stressing of the environment by spilling oil at sea.

4.6 Oil Slick Igniters:

Another project to ignite oil from the air directly resulted from the Balaena Bay experiment, where oil trapped in or under sea ice would surface on melt pools in burnable quantities as the ice warms in the spring. Ice movement studies indicated that oil from a subsea blowout that continued throughout the winter in the Beaufort Sea could be distributed over an area of some 16 000 km2, with burnable quantities of oil in perhaps 50 000 or more separate melt pools. Safety considerations aside, it would clearly be unrealistic to expect that people working on the ice surface could ignite the oil in all the pools in the three weeks or so that would typically be available before breakup and escape of the oil. An igniter that could be dropped from a helicopter or slow-flying fixed-wing aircraft was developed with the co-operation and assistance of Canada's Defence Research establishment at Valcartier, Quebec. Tests had shown that the existing devices developed for fighting forest fires did not produce sufficient heat to ignite oil subjected to the expected amount of weathering.

4.7 Laser Oil Slick Igniter:

Although air-dropped incendiary devices have been proven capable of igniting pooled oil, it was realised that they were still not an entirely satisfactory solution to the problem because of the associated logistics. The igniters have a shelf-life of 5 years, there are only a few places in North America that are equipped and approved to make such devices, and the production capacity is limited even in an emergency situation. There are also transportation restrictions to complicate further the task of getting a sufficient number to the right place in time. Upon learning that Physical Sciences Inc. in Andover, Maryland had achieved some success igniting pooled oil with a laser in their laboratory, they were awarded an AMOP contract to establish the design criteria for such a system. They were successful in doing so, as was demonstrated in a small-scale trial under typical late-winter conditions. An engineering study has shown that an operational system could be installed in a helicopter using existing technology, and a functional system could be built if needed.

5. SPILL-TREATING AGENTS:

Work has been undertaken through the AMOP on a variety of spill-treating agents, but most work has been performed on chemical dispersants.

5.1 Chemical Dispersants:

The Department of the Environment has issued guidelines on the use of chemical dispersants for treating oil spills. EETD tests dispersants that enter the Canadian market to check their effectiveness and toxicity in relation to national guidelines. Dispersants that meet or exceed the effectiveness and toxicity criteria are included on the list of dispersants accepted by the department for potential use in Canada. Decisions on actual use of dispersants, however, are made on a case-by-case basis by factoring in the particular circumstances of the specific spill situation.

Discussion about the utility of chemical dispersants is almost as lively today as it was following the original large-scale use during the Torrey Canyon incident over 20 years ago. There is still no undisputed evidence from large-scale experiments or actual use to demonstrate that dispersants are truly effective in dispersing oil. Moreover, no large-scale biological tests have convinced all environmentalists that the use of dispersants is safe in all conditions. The evidence is mounting, however, that dispersants themselves cause little ecological damage (above that caused by un-treated oil) and that they could, in some cases, reduce ecological damage if, indeed, they were effective in dispersing oil. In this regard, the BIOS Project, co-ordinated by the AMOP, contributed extensive information about the effects of chemically dispersed crude oil in a subarctic near-shore marine environment.

Since the late 1970s, over 100 experimental spills world-wide have been performed to test the effectiveness of dispersants and dispersant-application techniques. EETD staff have participated in many of these trials, and Canadian experiments, like the ones offshore the east coast in 1981 and 1983, and in the Beaufort Sea in 1986, have received AMOP financial support. The results from these trials have been variable, but indicate that dispersants are not highly (i.e., >50%) effective in the open sea, even under relatively controlled experimental conditions. This conclusion is only qualitative, however, since sound analytical tools for measuring oil slick thickness and oil concentrations in the water column do not exist to quantify dispersant effectiveness accurately under field trial conditions.

Extensive laboratory work on dispersant effectiveness has been performed under the AMOP. A variety of laboratory tests have been evaluated and developed to compare dispersant effectiveness and to determine the variability with oil type, temperature, salinity and other parameters. These efforts have been largely successful in explaining the very different and variable data which were generated by earlier laboratory experiments. The work has indicated that, if oil droplet re-coalescence time, mixing energy and inherent dispersability of untreated oil are taken into account, the results of the various laboratory methods can be suitably correlated. AMOP laboratory work is continuing to understand better the mechanisms at play when oil is chemically dispersed.

5.2 Other Spill-Treating Agents:

The AMOP has supported work on a variety of spill-treating agents such as sinking agents, herding agents, oil-spill combustion enhancers, oil biodegradation enhancers, etc. Most of these treating agents have very limited utility, and some have no merit. Currently, work is underway, through a joint-project agreement with US MMS, to develop standardized tests and criteria for assessing the performance of 18 types of spill-treating agent.

Since the mid-1970s, EETD has evaluated the effectiveness of sorbents that enter the Canadian market. To date, over 50 sorbents have been evaluated and the results published.

6. DISPOSAL:

Two methods of disposal of recovered oil and oiled materials have been addressed under the AMOP.

6.1 Burial:

Despite the recognized problems of operating land vehicles in the Arctic and the long-term terrain damage that can result, it was deemed prudent to be prepared for situations where there might be no other practical alternative along the shores of the southern Beaufort Sea. Selection criteria were established and possible sites were identified from aerial photographs.

6.2 Incineration:

Over $400 000 has been expended to develop a capability to incinerate oil in the Arctic and in other remote areas of Canada where it would be very expensive to transport oil and oil-contaminated materials to incinerators elsewhere. Simple wicking devices to collect and burn floating oil were found to be impractical. A prototype device that makes use of ultrasonic energy to herd, lift and atomize floating oil has burned-off emulsified crude oil under calm conditions with virtually no smoke. Subsequent experimental work at laboratory scale has established engineering tolerances and power requirements. A modified prototype has been tested in a tank under both calm and controlled wave conditions. These trails were inconclusive and, despite the early promise indicated by earlier trails, further work is on hold in favour of higher priority work. An air transportable pit incinerator has been developed for disposing of oiled combustibles. A rotary kiln assembled from readily available materials (e.g., used oil drums and car wheels) has been built and tested in co-operation with PACE, the Petroleum Association for the Conservation of the Canadian Environment. The design of this kiln is being re-evaluated in an ESRF/AMOP project, in an attempt to broaden the range of materials that can be treated.

7. AMOP R&D PLANS:

AMOP uses a co-operative approach to identify R&D needs and to plan and implement projects. A series of specialist advisory committees are used to help identify technical shortfalls and to promote research co-operation and co-ordination. This specialist advice is sought from the government, private and academic sectors in Canada and the USA. In addition, managers from co-funding agencies and spill-response organizations are also involved in the project selection and prioritization process. Over the years, this collegial approach has resulted in a significant level of joint-project agreements and co-operative work with a range of agencies inside and outside Canada.

There are still a significant number of unknowns to be resolved concerning the science and technology associated with cold-climate oil spills. For example, for fiscal year 1990-1991, the AMOP planning process has generated a list of research and development needs and a corresponding slate of proposed work, which includes almost 50 projects. Because of resource and expertise constraints, less than half the projects will actually be initiated in the next year.

The following is a list and summary of AMOP projects that are planned for the 1990-1991 fiscal year.

7.1 Cobble Washer:

Design, construct and test a field-deployable "remove-and-wash" technique for restoration of oiled cobble beaches. (Funding support from the Environmental Studies Research Fund)

7.2 SCAT Manual:

Produce a Shoreline Clean-up Advisory Team (SCAT) Manual for the Pacific Northwest by adapting the Exxon Valdez and Nestucca experiences. A number of our people were involved in the shoreline clean-up exercises associated with both of those spills, and many new techniques were developed.

7.3 Beach-Cleaning Rates:

Assemble existing data to predict basic estimates of oil fate and natural self-cleaning rates of coarse sediment beaches. (Funding support from the Panel on Energy Research and Development)

7.4 Pacific Coast Oil-Spill Project (PCOP):

Continue Phase 2 of PCOP which will address public and OGD input, approvals, financing, site selection, organizational design, and design of experiments in the plan. (Joint Project with the US MMS)

7.5 Modified Kiln:

Redesign, construct and begin testing the portable, mobile reciprocating kiln incinerator for cleaning oiled beach materials. (Funding support from the Environmental Studies Research Fund)

7.6 Water-Jet Barrier:

Redesign, construct and begin testing the flotation system for the high-pressure, low volume water-jet barrier. (Joint Project with the US MMS)

7.7 Boom-Test Protocol:

Finalize the draft boom-test protocol which will permit the evaluation of boom performance without the need to spill oil. (Joint Project with the US MMS)

7.8 Photo-Oxidation of Oil:

Extend analytical studies on the photo-oxidation of oil to determine the specific compounds produced. (Funding support from Panel on Energy Research and Development)

7.9 Oil Fluorosensor:

Complete construction of the prototype scanning (Barringer) laser fluorosensor for the unambiguous remote sensing of oil. (Funding support from the Department of Fisheries and Oceans, the US MSS and the American Petroleum Institute)

7.10 Oil Analytical Kit:

Develop a field kit for determining oil properties at spill sites. (Joint Project with the US MMS and the American Petroleum Institute)

7.11 In Situ Burning:

Continue planning for meso-scale and large-scale oil combustion experiments. (Joint Project with the US MMS and the American Petroleum Institute)

7.12 Slick-Thickness Sensor:

Continue the development of a sensor for remotely measuring slick thickness. (Joint Project with Esso Resources Canada and the US MMS)

7.13 Oil Properties Catalogue:

Continue determining the properties of oils in order to up-date the Oil Properties Catalogue. (Joint Project with US MMS)

7.14 Oil Emulsions:

Continue studying the mechanism of water-in-oil emulsification. (Joint Project with US MMS)

7.15 Guideline Compliance Monitoring:

Test spill-treating agents according to DOE guideline protocols to determine compliance with the performance and toxicity criteria and to support guideline development.

7.16 Marine Oil Spill Effects Book:

Revise the text and print the book: Oil Spill Effects in Canada's Coastal Environment.

7.17 Shoreline Clean-Up Course:

Develop course in shoreline-related oil spill response actions, including bio-physical characteristics, clean-up techniques, priority-setting and the SCAT process, and arrange training sessions for DOE staff.

7.18 BIOS Project:

Manage the remaining assets reserved for long-term test-site monitoring and publish a summary of nine years of observations on beached oil fate on an arctic shoreline.

7.19 Sorbent Evaluations:

Test sorbent products on a continuing and as-required basis.

7.20 Heavy/Submerged Oil:

Continue to investigate the behaviour and fate of heavy oils, including the mechanisms of over-washing and sinking, at laboratory and test-tank scale. (Joint Project with the US MMS)

7.21 Skimmer Evaluations:

Participate in test protocol development and skimmer testing in the re-activated US Environmental Protection Agency Oil and Hazardous Materials Simulated Environment Test Tank—OHMSETT. (Joint Project with US MMS and US EPA)

8. CONCLUSIONS:

I would now like to come back to the committee structures that we have in place. Over the life of the AMOP, since 1977, there has been a series of co-ordinational management committees that we have put in place. At various times the membership has changed. At one time the committee was called the AMOP Management Committee, but in the last few years we have restructured that committee and have called it the Spill Countermeasures Technology Committee. On this committee we have had representatives who are interested in both oil spill and chemical spill technology.

The current make-up in the Emergency Technologist Division at River Road includes: Canadian Coast Guard, Fisheries and Oceans, Indian and Northern Affairs, Canadian Oil and Gas Lands Administration, Canadian Petroleum Association, Canadian Chemical Producers Association and the US Mineral Management Service. This is the primary guiding committee that directs the AMOP program. In addition, there is a group known as our Regional Environmental Emergency Co-ordinators Team. This group is made up of our emergency co-ordinators in DOE, who are in the five regions throughout the country. They meet on a regular basis and discuss the R&D projects with those co-ordinators.

The other committee that has played a very active role in the last six or seven years at the international level, at least with the US, is the committee known as the OHMSETT Inter-agency Technical Committee (OITC). Despite the demise of OHMSETT four years ago, that committee continued to meet, although the membership went down from its original numbers to just the US MSS, AMOP and, occasionally, the US Coast Guard. It has, of course, become rejuvenated with the reactivation of OHMSETT, but it has been a very useful ongoing link with agencies in the US—particularly government agencies.

We also have a number of standing technical groups in which we involve experts from government and departments involved in this kind of business, industry, Canadian universities and the US. Some examples of our standing technical groups are: detection and monitoring, physical properties and behaviour, and spill countermeasures equipment. We also have other committees dealing with chemical spills. The staff members in the group are also involved on some international committees which give them linkages at the technical level with other people working on these kinds of problems in the US and Europe. We have members on a couple of the ASDN committees that are involved in developing standards for countermeasures equipment and treating agents. One of our members is also chairman of the OECD working group on remote sensing. So, we have a network in place that has survived despite the downturn in interest in oilspill R&D in the last six or seven years.

Some of the deficiencies in oilspill countermeasures technology have been recognized recently in North America as a result of damage caused by the Exxon Valdez tanker spill in Alaska, and the Nestucca barge incident off the west coast. As a result of this realization, numerous US and Canadian organizations are entering, re-entering, or accelerating their work in the marine

oil-spill R&D arena. In order to gain full benefit from this increased activity, it is important that the players take considerable care not to duplicate previous or ongoing work, and that existing and new R&D efforts are efficiently co-ordinated.

AMOP will continue to focus on marine, cold-climate oil-spill problems and has a track record of co-operation with agencies inside and outside Canada. New initiatives in the area of cold-climate marine oil-spill research and countermeasures technology development should build on the expertise and knowledge that has been developed through AMOP. Ideally, new work should be co-ordinated through the existing linkages and management mechanisms—adapted as necessary to accommodate the legitimate interests of organisations entering or re-entering the field.

REFERENCES:

This paper is essentially an update of the following paper:

Meikle, K.M., "The Arctic and Marine Oilspill Program—AMOP", Proceedings of the Alaska Arctic Offshore Oil Spill Workshop, National Institute of Standards and Technology, NIST SF762, April 1989, p.117-131.

Information has also been added from:

Fingas, M.F., "Dispersants: A Review of Effectiveness, Measures and Studies", Workshop on Oil Spill Dispersants, NOAA, Arlington, Va., 1990, 19pp.

SHERROLD MOORE:

Thank you David. Our next speaker and last for this morning is Don Gilman, Mayor of Kenai Peninsula Borough, Alaska. He went to Alaska in 1968 and lived in Seward from 1969-1976. Don and his wife Nicki have two boys.

Don was principal of the Seward High School in 1969. He left that position at the end of the year to become the first Education Director of the Alaska Skills Centre. He became the Borough Mayor for the first time from 1975-1980. He served in the Legislature from 1981-1985. Don is also a businessman, who owns liquor stores in Alaska.

Mr. Gilman will speak on "The Public Viewpoint."

DON GILMAN, MAYOR
Kenai Peninsula Borough, Alaska

THE PUBLIC VIEWPOINT

A lot of what I was going to say today about oilspill technology and the planning that is going on both in the US and Canada has been said. I have learned in the last few years, since my last term in office, that there are some acronyms that deal with hazardous materials, oil and other matters, like NIMBY—"not in my backyard". But I ran in to another one after the Exxon Valdez spill. It's called NIMTO—"not in my term of office". I have spent the last 13 months, at least 50 per cent of my time, working on the after-effects of the Exxon Valdez spill. If I had a title to this speech, I think it would be "Who the Hell Do We Believe?" or, if we are talking about oilspills specifically, "Who's in Charge?".

Envision, if you can, March 24, 1989. The fishing season was about three weeks away—the first herring season. Salmon season starts in the latter part of May. We are talking about the residents of this area (Prince William Sound, Kodiak Island, Cook Inlet) and the fisheries, something in the neighbourhood of $250 million. And the tourist industry, with $100s of millions in tourist money. And everybody is gearing up. Then, we have the oilspill, which sits there on the water for about five days, with no response to speak of. A 70 knot wind blew this oil slick almost 70 miles into some islands and it was gone. It was over as far as trying to clean up that oil and getting it off the water.

I have heard a lot of the things said today. We heard things prior to the TransAlaska Pipeline being built. In 1973-1974 we debated double bottoms and double hulls, and the American shipping industry won that—it did not have enough information. There were some inherent dangers with double hulls; they had not quite studied it all. The oilspill question came up. Alyeska, the operator of the pipeline, will be responsible, and there will be certain standards for cleaning up—address an oilspill within five hours, be on the spill within five hours. Well, that did not happen. They were on the spill about five hours later with one vessel that had a little bit of a boom. The public reaction to this was—and if you think of how Alaska lives off the oil industry, oil royalties, oil taxation, etc.—a position of anger, frustration. We felt that we had been misled by the industry. We were dismayed that it could happen, and felt that there had been a lot of deceit.

When we found out, for instance, that all of Alyeska's equipment was on the beach under four feet of snow; that there were no agreements on the use of dispersants and when to use dispersants; and that we had a federal system called the Regional Planning Team, and they were to have control of the federal response—the Coast Guard, Mineral Management, etc. They were paralyzed. There was no response. None. Zip. Zilch. What happened was very predictable. Congress started hearings and they pointed fingers at the industry, at the state, at the Coast Guard. And the state Legislature started hearings, and they pointed fingers at the Coast Guard, at the industry, at the federal government, at the state administration. Finally, somebody said, "Hey, didn't we cut the

Department of Environmental Conservation's budget last year?" Then they began to point their fingers at themselves. But, what happened was the whole system broke down; there was no system. The President of the US said, "We ain't touching this; we aren't federalizing this thing—Exxon is big enough to take care of itself."

So the aftermath was that you heard that Congress was going to pass some legislation. Our state Legislature passed a whole bunch of legislation last year—$.05 per barrel tax, building up to $50 million for our own spill fund, local response corps to be located in all communities, equipment caches provided for regional plans and training. The federal legislation that is going to pass has an element in it that has not been discussed today, and I think this behooves me to spend some time on that.

The federal legislation will require that, in Alaska only, marine terminals and the operational marine terminals must have a local advisory group as specified in the statute. The advisory group will be patterned after a solemn vote in the Shetland Islands where the local people are in charge and have a lot of say over what happens in their particular area. In fact, in one of our newspaper clippings a visiting Scottish Member of Parliament remarked, "How extraordinary that you flay the Exxon Corporation, but leave the government alone. In Europe it would be the opposite case. Dereliction and government oversight would be the source of outrage." The advisory groups will fit into some type of local response corps. As early as yesterday morning, there were response corps agreements that had been signed over the weekend, so we truly will have a public/private system in Cook Inlet that will oversee the operations and particularly the prevention and clean up of oilspills.

Our Legislature did something else. It created the Oilspill Commission, and I have with me one volume—there are four volumes—giving the chronology of the first 40 days of the Exxon Valdez oilspill. But, I have to refer you to the other three volumes and give you some of the items that they touch. The first volume deals more on the local scene, but does get into such things as role of insurance for the preparedness and response to oilspills, liability and compensation issues (written by the mitigation and assistance corporation). Volume two is an assessment of tanker safety, The Exxon Valdez Oilspill a Re-Assessment of Oilspill Clean-up Technologies: an overview of the spill response in the Alaskan, Arctic, Bering Strait to the Canadian Border. It would be well worth your time to read that, but do not take it all as gospel; it is, in my opinion, a biased report—written by an oil commission that was appointed by a governor of the state. It does have some good, thought-provoking material in it, though.

Going back to the title of my speech—"Who the Hell Do We Believe?"—everybody has hired his own scientists. Exxon has its scientists, the state has its scientists and the federal government has its scientists. Where does the public get its information? It gets it out of the newspaper, off the television. For example, a newspaper clipping of a noted biologist, dated February 8th: "Biologist says spill changes Sound forever, marine life will resume in new form." Another from March 1st: "Tests show most fish are safe." March 29th:

"Exxon study, minimal impact on birds and fish." "Alaska official in front of Congress." The official tells of the spill's grim legacy; he says that the direct lethal effects are probably the most dramatic. Who has not seen pictures or videos of dead and dying sea otters and sea birds? He went on to make a statement about the reproductive cycle of some of the salmon, and it was absolutely false, but he had made it in front of Congress. His own people were scrambling trying to get it corrected, but as far as the public was concerned, it was true.

"Exxon official gives glowing shore report." Homer newspaper, a little Santa Barbara of the north: "Was the spill really only 11 million gallons or was it 38 million gallons—Exxon figure disputed by biologist". The Secretary of the Interior, on the same page: "Mother Nature has done a lot." And here is one I really like (April 16th): "Spill studies continue—mink eat crude oil." That was a study being done where they were feeding mink a diet that had one thousandth or a millionth hydrocarbon in it to see if it would do anything to its body or affect its reproduction, and they forgot the reproductive cycle was a little longer than the study was funded for.

What do you do if you have 11 million gallons of oil, and it went 500 miles down the beach, and it oiled at least 300 miles, and there is still some oil left, and it's in a pristine area and nobody lives there? Well, the fish live there, and the animals live there, and that is a good part of our culture and heritage, and everyone is concerned about that. Technology has not caught up with this one.

So, we are trying something called "Bioremediation." Bioremediation is—and I am not a scientist—a process of fertilizing the little microbes that occur naturally, causing them to grow and reproduce faster so they will eat the oil. And the stuff works. But the debate is: What is the fertilizer going to do to the environment, and what happens if it gets out into the water? We don't know. We have started a spill-advisors' plan on clean-up methods that talk about bioremediation.

Here is a article responding to what someone wrote, and the person's name is Hans Johns, Technical Department Exxon. He is using an example from the Canadian Environmental Emergency Technology Division. Then we see that Exxon may resume oilspill clean up this week. April 19th: "State is still undecided on clean up. Does not know if it will allow bioremediation." "New Exxon studies of dubious clean up method." "It's okay, Noah is out there beating the bush for bioremediation." "Fertilizer oil clean up under the attack." "Ocean bottoms may be damaged." "Crews spread boom in Sound." The Coast Guard takes everybody into a room and shuts the door, and they discuss what they are going to do in the clean up. A closed meeting. We have a open meeting law in Alaska that says public officials have to meet in public. "Kelso—Department of Environmental Conservation—State won't boycott closed oilspill meetings."

This is where we are.. We, the public, do not know what the scientists are telling us. We do not know what our bureaucrats are doing. We do not know what is happening behind that closed door. We have some hope and trust that

we can apply to this situation because there is no one who can keep a secret in Alaska. It lasts about 45 minutes, and everything is out on the table.

Industry has tried to do some things, and I noticed that some of the discussions we had here were cleaning up the image a little, and maybe some advertisement that might go with it. The industry has tried that up in Alaska. There is a group called the Alaska Oil and Gas Association (AOGA) and they advertise a lot. This is a BP ad: two snow geese; deeds not promises; and it tells how diligent we now are as far as oil clean up goes. Here is another one. It's called a "Sound Protection System", Alyeska Pipeline. And here is another article from one of the small newspapers that says, "What is the point of offering comments if they are to be refuted during the meeting, point by point, by the hired mouth from Alyeska?" And then the AOGA ads have said, "Four out of five Alaskans think that the oil industry is beneficial". And here are two ads, telling them what to do with their advertisements, and one is paid for by AOGA—Artists Against Oil and Gas Abuse.

That is where we are in Alaska. I do not think that it is unusual and it would be the same in Canada, particularly in the northern areas. We have a lot in common in that respect.

The public view right now is that industry can't be trusted to police itself. We call that something like "the fox and hen-house effect". Public involvement is critical for both government and industry if we are, in fact, going to solve these problems. Technology is not available for large spills. The president of ARKO Shipping made a public statement in the Oilspill Commission. He said, "When it goes over 10 000 barrels, it is going onshore. There is nothing we have that can pick it up." Now I do not know whether that is true, but that is a statement made by someone who ought to know.

The public thinks that industry is trying to buy its way out of this one. There is a saying in small business about success and how you can be successful. There are three principles: location, location, location. I would submit that the three principles for industry oilspills is: prevention, prevention, prevention!!

Thank you very much for having me.

SHERROLD MOORE:

Thank you very much to the Mayor of Kenai Peninsula Borough, Mr. Don Gilman. Before we wrap up, I would like to entertain a few questions.

AMOCO:

We have all these agencies; we have all these committees; we have all these reports. Admittedly the Exxon Valdez incident has probably woken up a few people and officials. What are we doing to ensure that the same thing does not happen again? That the oil does not sit there for five days? That we have all the different groups, and we really do know who is going to get the ball rolling

and get something done? How are we making sure that all these different groups have really integrated as a cohesive team?

MICHAEL TURNER:

Essentially, part of the Coast Guard's response mode is that we have a policy across the country: we simply respond immediately; we do not wait for the spiller or ship owner to react. If he does respond, and respond adequately, we back off. In terms of co-ordination between the various agencies, there is no question that that is a difficult call, a difficult challenge, because there are many different agencies of government, all of which have very legitimate responsibilities and obligations under their particular statutes and ministers. We have to ensure that we all work closely together. In our case in Canada, we try to do that through this device called REET. We have a command system, in which for ships or spills, the Coast Guard provides the on-scene commander and is in charge of the lead agency. This lead agency, a resource agency concept, exists throughout the government, for all kinds of emergencies, not just for oilspills.

Therefore, we are the lead agency, and COGLA would be the lead agency for an offshore exploration or production accident. We also have a mechanism beneath that, in our case, the on-scene commander, and his guys who carry out the actual operation and co-ordination. Through this REET, we try to get together all the various agencies and organizations that have something to say about how the job should be done to feed one co-ordinated viewpoint to the on-scene commander—and that advice is almost invariably accepted.

It does bring to mind one thing that Don said, about the law of public meetings, and the problems of the US Coast Guard going behind closed doors to talk about how it is supposed respond. At the beginning, there was a situation on the west coast with a spill for which we were royally tarred and feathered—the Coast Guard in particular—for the way we handled it. I recall the comment from the European. Here in Canada, it is the government that gets roasted rather than the industry on many occasions. We were being roasted by the press, which was saying that there was no co-ordination, that nobody knew who was in charge, that there were all these agencies and they were all fighting and bickering.

What really led to these sorts of statements was that we did something unusual. In that case, the regional environmental emergency team wanted all the different agencies to get together and hammer out what should be done, and how—what the priorities were, what the best methods were, etc. It held its meetings in public, in a very open way, with all the local communities attending as well. The result was that there was a royal dog fight in these meetings about who was right and who should do what next, etc., and that is perfectly legitimate, because you have differing opinions from differing backgrounds, and differing technical capabilities. But, when you have that kind of all-out dog fighting behind closed doors, at the end of the hour the guy comes out of the room and tells the on-scene commander, "This is the consensus. You have to

do...". Then you get a very different image from what you have when the dog fight occurs in front of the public and they say, "No one is in charge. They don't know what they are doing here!"

As I said earlier, the world is not a simple place. We do have to find better ways to co-ordinate and communicate between the various agencies, but I would suggest that doing that in a very public forum is self-defeating and very destructive of the image that the public gets of the capability of government and industry to work together. Of course, we have disagreements and arguments, but the more we have those disagreements and arguments in a time of crisis, the more we give the public an image that no one is in control. What is really important, going back to your question, is that we have to do more of this beforehand; we have to be prepared, and plan better. We have to have better co-ordination among various agencies to know who is doing what, etc., well before there is any kind of spill. At the end of the day, as Don said in his closing remarks, the solution to pollution is not dilution—it's prevention. We have to stop the accidents in the first place.

SHERROLD MOORE:

One last question and I am going to ask it. Mr. Mayor, we have a lot of people here today, both ministry and government agencies. I would be interested to hear what you have to say about this meeting today and your opinion of what you heard from the public's viewpoint. Would you mind commenting on that?

DON GILMAN:

What I have seen in the last two days is a rather unique set of circumstances from my perspective, because we do not usually have symposiums where we have the leaders of the oil and gas industry and the regulators in the same room. Sometimes that happens, but not to this degree, and I find that very refreshing. If this were attempted in Alaska it would be divided, half over there and half over here. But I still think that the discussion we have had in the last three minutes is the key—and you are getting there—to solve the problems as best you can before you have a spill. A spill is not the time to try and determine whether you use dispersants or whether you burn—you do that up front. Don't let the studying continue [inaudible]

SHERROLD MOORE:

Very good, thank you Don. It is just about 12:30, and we have a buffet upstairs. I would like you to join me in thanking these panelists in this Part II. I would also like to thank Bob Dryden.

SESSION VI

RISK EVALUATION/ CANADIAN STANDARDS

INTRODUCTION

STUART AITKEN:

It is my pleasure to be your chairman for the first session this afternoon. It is also your fate that I will be your chairman for the second session this afternoon. We believe the two sessions do hang together, so we hope the audience will also hang together. Those who do not return after the coffee break will lose their bus privileges and will have to walk up to the barbecue.

In the sessions this afternoon, we will return to the theme of this year's workshop—"Bringing it to Market." In some of the discussions and presentations yesterday we talked about what "it" is—the discovered resources on our frontiers. Richard Dingwall discussed them in some detail. After a lot of travail the industry has found that initial quantum of resource on several of the frontiers that would warrant the construction of a transportation infrastructure to get it to market.

We have also heard several times that the market is there, that the appetite south of our border is getting larger, and its self-sufficiency in oil and gas is rapidly diminishing. Those are two legs of the stool. The third leg is price.

We have the resource and we have the market. We now have to address the difference between our revenues and our costs—and we do not have any great reason for optimism on the revenue side of that equation. The industry is addressing the subject of costs very closely.

In the early days of the offshore, particularly in the more hostile areas, it was sufficient for us just to go out there and build things. To increase strength, we added an eighth of an inch to last year's model and used other such approaches. These, unfortunately, were far too expensive. They would frustrate today's explorers because they would deny us the ability to look for smaller frontier accumulations further down the road.

We now have to re-examine what we can do about those costs in our own frontiers, in the North Sea and worldwide.

We have broken down this afternoon's sessions into two parts. In the first part, we will be asking, "What really do we need?" In other words, "What is the basis of prudent design for inhospitable waters and for extreme events?"

We cannot afford to overbuild, nor can we afford to design with large factors of ignorance. We are also going to talk about extreme events, especially one that is peculiar to Canada: icebergs. And we will ask whether we should be afraid of the iceberg.

Probably we should be afraid of the iceberg, but we should no longer be in terror of the iceberg as we were a while back. We are now beginning to understand the iceberg, and we will have an up-date from Jack Clark on improving our understanding of it.

The last of the speakers in the first part of the session will talk about the work that has gone into developing Canadian standards for offshore structures and about the current re-examination of existing codes now in the international community.

Our first speaker this afternoon is Dr. Touraj Nasseri. Touraj is president for the Centre for Frontier Engineering Research (C-FER). He holds a BSc and a PhD in engineering from Manchester and London Universities in England. He has had extensive international experience in engineering research, design and technology management. In 1982, Touraj joined Det Norske Veritas Canada Limited in Calgary, where he held positions of increasing responsibilities for management, R&D, and consulting functions.

His R&D efforts concentrated on engineering systems reliability, safety and risk management pertaining to petroleum exploration, production and transportation. He was president of DNV Canada before being appointed president of C-FER on March 1, 1989.

Please join me in welcoming Dr. Touraj Nasseri.

DR. TOURAJ NASSERI
President, Centre For Frontier Engineering Research

DESIGN FOR EXTREME EVENTS: APPLICATION RISKS ANALYSIS

INTRODUCTION

It is perhaps a risky proposition to speak of the intricacies of risk analysis directly after so sumptuous a lunch and expect an attentive audience. Let me assure you that I have promised the Chairman to refrain from using mathematics and from being abstruse, despite the affinity of risk analysis and its practitioners for both.

The technoeconomic risks in petroleum business constitute a vast and complex subject, a few aspects of which can only be touched on here. However, I wish to convey the following message. A good understanding of the risks and their effective management will provide a powerful and essential tool for bringing the frontier resources to the market safely and economically. The adoption of risk management technology considerably enhances the quality of managerial and technical decisions on the feasibility of major development

projects. Furthermore, it enables management to develop a sound rationale for the timely adoption of highly beneficial technological advances.

The potential of risk management technology is greatest when it is fully integrated with the engineering, evaluation and operation of the human-machine systems that are deployed in the development and transportation of frontier resources. However, the realization of this potential has not been vigorously pursued; not least because of the lack of a coherent and unified method for risk assessment instead of an array of techniques rooted in the traditions of different industries. Here is a short list of mind boggling techniques used in risk analysis: hazard analysis, hazard and operability analysis, failure mode and effect and criticality analysis, consequence analysis, fault-tree and event tree analyses. We need to identify the common features of these techniques and clarify their relationships and functions, as there is much scope in elucidating the communication between the risk analyst and the decision maker.

DEFINITIONS

I wish to define the two key words in the title of this presentation: Extreme Events, and Risk. Extreme events are occurrences of exceptionally high or low magnitude of effect which are, in engineering, associated with low probability; examples are large waves, strong earthquakes or massive bodies of ice. This definition is not complete without specifying what is meant by low probability, which depends on the application, but events of annual probabilities of 10-2 or less are typically regarded as extreme in engineering design. Extreme events often control the design and operation of exploration, production and transportation systems which are subjected to them. The so called "worst-case scenarios" are defined in terms of design extreme events which are estimated by the application of the statistical and probability theory of extreme values. For engineering design purposes, the probabilistic description of combination of extreme events is often required. Another class of extreme events consist of operational accidents which are the causes of most failures.

Risk is the chance of loss. This is a short definition but captures the essence of the concept of risk: the probability of a loss-causing event (accident) and its quantified loss. The word loss has its roots in old English meaning destruction but it is used here to mean various degrees of damage including destruction. Risk is mathematically defined as the product of the probability of an accident and its consequent loss; we need to be able to quantify the loss on some numerical scale for the application of the mathematical definition.

RISK ANALYSIS AND OPTIMUM DESIGN

The safe and economic development and transportation of frontier hydrocarbon resources requires that we search and find optimum solutions to complex engineering and operational problems. Optimality is achieved by the most efficient allocation of resources to meet the safety and economic goals.

Safety is of course the most important goal of engineering design; safety is used here in a broad sense to mean the protection of people,

environment and resources. The purpose of safe design is to provide for measures that prevent accidents and control their consequences. Design must also be economic by achieving safety and operational reliability during the system design life at the least cost.

The risk management strategy is a decision support system that should be applied throughout the creation and performance of engineering systems. The strategy is formulated by the following key procedures:

- Integration of engineering and operational considerations;
- Analysis of information on operational experience, failures, and equipment reliability;
- Development of critical design conditions, including accident scenarios and quantification and ranking of risks;
- Development of optimum options for design and operation for various levels of risk;
- Select a design-cum-operation solution on the basis of the acceptable risk level; and
- Integrate the information on design risks into a monitoring and control system so that the risk profile can be updated as operational experience becomes available.

Figure I schematically illustrates the above procedures which uses risk analysis for establishing the design and not, as is commonly used, for checking purposes at the conclusion of the design. The iteration process provides economically the system safety characteristics that will, by accident prevention and damage control, assure a design which meets the safety criteria. The process should also generate information on relevant operational management and practice that must be implemented to achieve the safety goals.

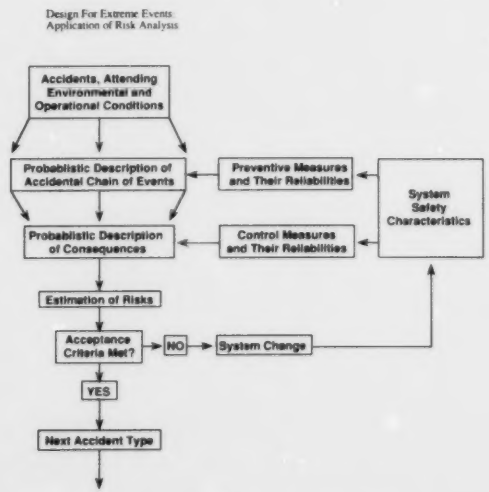


FIGURE 1. RISK ASSESSMENT AND CONTROL PROCEDURE

It is noted that the sources of hazards and the effectiveness of the preventive measures are represented probabilistically in order to incorporate randomness and uncertainties which are unavoidable aspects of reality: so the probabilistic approach is not a choice but an imperative.

APPLICATION

Risk analysis is most effective as a design tool if it is employed at the conceptual stage of a design, and is evolved with engineering and operation. For a number of years, the offshore drilling and production platforms for operations in the North Sea have been subjected to a conceptual safety study which is a significant step towards the use of risk analysis to direct and influence design from an early stage. The study identifies the possible accidents for an offshore platform and estimates the probabilities of each accident. It then assesses the capability of the platform design to prevent or control the consequent damage. The draft regulations of Canada Oil & Gas Lands Administration (COGLA) also stipulate a similar safety study.

Accidents are divided into two groups on the basis of annual specified probability level (currently 10-4 for the North Sea). Accidents with probabilities less than the specified value are treated as Residual Accidental Events (RAEs) and not pursued further; other accidents are termed Design Accidental Events (DAEs). For every DAE, the safety functions of the platform or of the vessel that are essential for the protection of the people and the environment are analyzed to ensure their integrity under the accidental conditions. The greatest advantage of this safety evaluation lies in the process which can reveal how significant reduction in risk is achieved at no or little extra cost, and not in the numerical probabilities that are estimated. The process often result in highly beneficial qualitative solutions for significant risk reduction, such as changing the lay-out of the topside facilities, or changing the location of the safe haven or the design of escapeways. Furthermore, the integrity of safety functions requires that the safety systems are designed for the criteria, such as loads or pressures, that result from the analysis of the design accidental events.

EFFECTIVE RISK MANAGEMENT

I have stated that extreme events often control the design of engineering systems. For example, the design process for an offshore platform starts by identifying the failure modes of the platform under specific environmental and operational conditions. Design ensures that the probabilities of the critical failures - criticality being determined by the consequences of the failures - are below specified levels. This is tantamount to ensuring that the risk is acceptably low. Codes of practice attempt to systematize this process to help designers manage risk.

One way of categorizing failures is by their causes: gross errors; accidents; and inadequate knowledge. The inadequate knowledge category includes deficiencies in the available technology, experience and design standards. Failure statistics show that the vast majority of failures are due to gross errors and accidents: human error is often cited as the cause of accidents, but all errors are human, as nature mistakes not, nor can it be fooled! The

critical risk issues are therefore to be addressed by quality assurance (for gross errors) and safety analysis of the kind discussed here. In fact, a comprehensive quality assurance system may well subsume safety considerations.

Reliable and properly analyzed information from performance monitoring and accident investigation will considerably enhance the effectiveness of risk analysis. We must establish a mechanism to create this information source on a global basis. There is considerable data on offshore accidents which are valuable in performing risk analyses*. Offshore exploration and production activities are of course uniquely hazardous as both marine and industrial activities may cause accidents; some of these are listed in Figure 2. The data bases also contain information on the frequency and extent of different damage types and on fatality (Figure 3). Accidents have also categorized by the operational mode (Figure 4). The statistical tables are self-explanatory. With reference to Figure 3, which shows the number of fatalities for all mobile and fixed units, the expected correlation between the total loss of platform and fatality is confirmed. 205 of the 359 fatalities accompanying platform losses were related to mobile units. There is also a significant number of fatalities associated with minor or no structural damage. Furthermore, the structural damage as the initial accidental event was principally due to inadequate quality assurance and not due to design extreme loads being exceeded. The statistics for fixed platforms also show that blow-out and fire are the principal causes of major accidents. These statistics should also be heeded for the efficient allocation of resources to improving safety and reliability of offshore

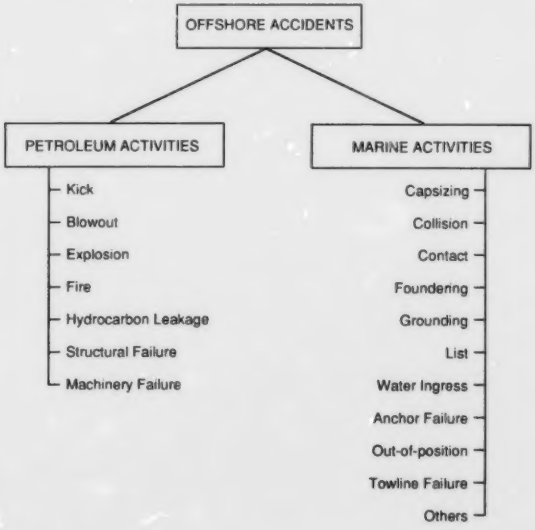


FIGURE 2.

INITIAL EVENT	DAMAGE						
	TOTAL LOSS	SEVERE	SIGNIF.	MINOR	NO DAMAGE	NOT KNOWN	TOTAL
Anchor Failure	-	-	-	-	-	-	-
Blowout	6	18	44	21	-	-	89
Well Problem	-	1	-	1	-	-	2
Capsize	4	2	-	-	-	3	9
Collision	-	-	3	6	-	-	9
Contact	-	-	10	-	-	-	10
Crone Accident	-	-	6	-	3	-	9
Explosion	-	2	5	3	5	2	17
Falling Load	-	-	-	-	2	-	2
Fire	-	6	4	4	1	-	15
Foundering	-	-	-	-	-	-	-
Grounding	-	-	-	-	-	-	-
Helecopter Inc.	12	-	-	25	11	-	48
Leakage	-	-	-	-	-	-	-
List	-	12	-	-	-	-	12
Machinery Malf.	3	-	-	-	-	-	3
Off Position	-	-	-	-	-	-	-
Spill/release	-	14	1	-	-	-	15
Structural Damage	250	-	-	5	-	-	255
Towing Incidents	-	-	-	-	1	-	1
Other Incidents	84	17	-	7	21	3	132
TOTAL	359	72	73	72	44	8	628
TOTAL PERCENT	57	11.5	12	11.5	7	1	100

FIGURE 3. NUMBER OF LIVES LOST AND STRUCTURAL DAMAGE FOR DIFFERENT ACCIDENTS - ALL UNITS WORLDWIDE, 1980 - 1987

Source: WOAD 1988 - Veritec

OPERATIONAL MODE	ACCIDENTS %
Drilling	27
Idle	2
Operating (non-drilling, non-production)	9
Production	31
Construction/Maintenance	5
Accomodation or Support	2
Transportation	14
Other	10

FIGURE 4. ACCIDENT FREQUENCIES FOR DIFFERENT OPERATIONAL MODES - ALL UNITS WORLDWIDE, 1980 - 1987

*For example, see "WOAD" Statistical Report 1988, Veritecplatforms.

Automation, improved communication of risk to the decision makers and the public, a more effective and timely application of technology promise much potential for safer and more economic development which the industry must realize. The adoption of risk management strategy equips decision makers in the public and private sectors with the technology to effect resource development with due regard to safety. Such developments are progress indeed, and progress is driven by a sense of adventure. I would therefore like to conclude my talk with a quotation from an eminent philosopher and mathematician, Bertrand Russel. I do not suppose he would have been invited to attend this kind of seminar that is, when he was alive. However, he said "a life without adventure is likely to be unsatisfying, but a life in which adventure is allowed to take whatever form it will, is likely to be short."

STUART AITKEN:

Thank you Touraj. Our second speaker in this session is Jack Clark, who is going to bring us up-to-date with the work that C-CORE has been doing to further our understanding of icebergs: our ability to locate them and to understand where they are going next.

In some ways, the work Jack is doing can help us see the iceberg in a context similar to the hurricane in the Gulf coast. Hurricanes can also do a great deal of damage, but we are able to prevent risk to life and the environment because we have a fair knowledge of their arrivals and probable courses. Certainly, when we started out in the Grand Banks we had no such information about icebergs. They were terrifying things that would appear out of the fog. We did not know where they were or where they were going. We only knew they were likely to be bad news.

Jack Clark has been director of the Centre for Cold Ocean Resource Engineering (C-CORE) for six years. Prior to that, he spent 25 years in consulting engineering primarily in western Canada and the Arctic. From 1972-1977, he was Director of Geotechnical and Environmental Studies for Northern Engineering Service—consultant to Canadian Arctic Gas Pipelines Ltd. He is a fellow of the Engineering Institute of Canada and a fellow of the Canadian Society of Civil Engineers. In addition, he serves on the editorial boards of several technical journals and on several advisory and professional committees.

Please join me in welcoming Jack Clark.

JACK CLARK
Centre for Cold Ocean Resource Engineering

ICEBERGS—WHERE ARE THEY AND WHERE ARE THEY GOING?

Thank you Stuart, ladies and gentlemen. Stuart has given a very good introduction to my talk by pointing out that the main difference between the Canadian offshore and other regions in the world, where offshore development has taken place, is the presence of ice either for part or most of every year. There are, obviously, areas where this is not true, but most of the regions that

are being considered for development are ice-invaded for at least part of every year. This is the design challenge, to be able to accommodate that phenomenon. There has been a tremendous amount of research into this problem over the past 20 years. The work of Esso, Gulf and Dome, in particular, has resulted in remarkable achievements in the Canadian Arctic.

Our own organization has been doing research work on ice since we began 15 years ago. It is one of three areas of research that we pursue. The others are seabed geo-techniques and remote sensing. All three are very closely linked, as I will show today. We now have about 60 permanent staff, and we go up to about 70 people in the summer. We enlarge upon our work-base by co-operative projects. Practically everything we now do involves at least one, if not several, other organizations—typically industry or consultants, but also government laboratories and other universities.

A speaker this morning said he felt co-operation was essential in the world of research related to oil spills. I agree, but suggest that in any area of Canadian research, it is essential we can draw upon networks and each other's capabilities. There are also several other practical reasons, which I will touch upon in a few moments.

As we say in Newfoundland, I am going to talk about "Hicebergs—Where are they and where are they going?" I would like to begin by acknowledging the contributions of my co-authors Mona Heltahan and Rafid Can. I will talk mostly about where icebergs are going, even though, in actual fact, our own research efforts over a period of 12 years have been very intensely directed towards determining where they are. We have had a tremendous amount of support in that activity, and I would like to acknowledge that before I start. C-CORE is a fully self-reliant research organization.We receive a tremendous amount of support from several sources—particularly in our radar research. Mobil, Petro-Canada, Husky, Bow Valley, Esso and Gulf have given very strong support, as have the Department of Fisheries & Oceans, the Department of Development in Newfoundland, EMR, COGLA, ESRF and NSRC. The risk, of course, in acknowledging all this is that I have left someone out. If so, I am sure I will hear about it afterwards.

Where do icebergs come from? Most of the icebergs off the east coast of Canada come from Greenland, particularly the west coast of Greenland. They follow the path (shown on the slide) coming south through Iceberg Alley, to the dotted line showing the southern limits. Total travel is about 1800 nautical miles and takes two to three years. Icebergs are very much influenced in the direction they go by the currents and a number of other features. Approximately, 10 000 to 30 000 icebergs are spawned in Greenland every year, very few of which ever reach the Grand Banks area. Our measurements are usually made at the 48th parallel and all the data that I show you will relate to that. On average there are about 400 icebergs every year.

But a lot of them never get very far away from Greenland. This is an example of a grounded iceberg that sits and breaks up into smaller pieces.

I am often asked about the biggest iceberg I have ever heard of or seen, and this is it. This was provided by a colleague in Denmark. From water line to peak is 175 metres and it stretches well back out of the picture. It was measured above and below water, and the total weight was calculated to be 310 million tonnes. We will never see one of those off Canada.

The numbers of icebergs crossing the 48th latitude vary tremendously, as illustrated here. Incidentally, if you go back before 1960, using what data was available then, you just see clusters of peaks. The most is around 2000. The least is 0 (in 1966). Many years there are very, very, few. I am told this year, from a researcher's point of view, is going to be a very good year.

The factors that control iceberg motion, that is, where they go and how they move, are the environmental forces, currents, winds, waves, the coriolis acceleration, ocean surface slope, the shape, size and area of the iceberg (above water and underwater shapes) and the draft (particularly as it relates to grounding).

The terminology is now pretty much agreed upon: large icebergs are typically up to 200 metres in length; and anything over that is very large—about the size of a rig. Medium is about the size of a supply vessel. Small is the size of a long liner. And bergy bits are about the size of a survival craft. The growlers, which are the most predominant form of icebergs, are the size of a dory. The average draft is 50 metres and the maximum 160 metres. The maximum mass is 400 million tonnes. The approximate weight of ones we see south of the 48th parallel vary from approximately 1000 tonnes for a growler up to 10 million tonnes for a large iceberg.

I will quickly show you some statistics, but will try to give you a feel for the data, relating it to what Touraj was talking about in the risk analysis. On the average, for icebergs crossing the 48th, we are right at the peak of the season now. Most cross in April or May. Ninety-four per cent cross between March and August, the other six per cent at other times.

As I mentioned, icebergs are influenced by currents and, over the years, we have been trying to get more information on where they go and how they move through the water, so that when they do impact a seabed we will have better design parameters. A lot of these studies have involved placing instrumentation on icebergs. These are motion sensor packages we deploy on everything from growler size up to the very large iceberg.

From those slides and general comments, I will move on to the formal section of this presentation.

The development of offshore oil and gas on Canada's east coast in iceberg-frequented waters has reinforced the need for research and development work on icebergs. Icebergs are of particular concern to Canada's offshore oil exploration and production operations and related activities, since the wells on the Grand Banks lie directly in the path of the annual north Atlantic iceberg migration route.

To protect drilling vessels, some icebergs are deflected by towing; if the icebergs are untowable, the vessel is moved. Both strategies require warning systems to provide information on approaching icebergs with sufficient lead time to take defensive action. This information can be provided by reliable systems that detect iceberg locations and forecast the probable future drift path of the iceberg for the next 12 to 24 hours. Such forecasts could be applied to manage activities on an offshore site and vessel traffic around it and to maintain optimum drilling and production operations.

The projected increase of marine activity in ice-invaded waters has initiated a number of developments in remote sensing methods for ice hazard detections. Numerous advances have been made in discriminating between icebergs and multi-year and first-year ice. Many types of microwave radar systems have been applied to ice detection and classification. These include surface-mounted and airborne microwave radars, airborne and spaceborne synthetic aperture radar (SAR) and spaceborne passive microwave systems. A common feature of all these methods is their line-of-sight operation. For a surface-mounted sensor, in an ocean environment, this limits the range to well under 20 nautical miles. Airborne or spaceborne sensors have a much greater range, but their coverage is limited to the periods of the over-flights.

This paper describes some background information about icebergs, iceberg detection and ice forecasting systems currently under development at the Centre for Cold Ocean Resources Engineering (C-CORE). There is an emerging radar technology for surface-mounted ice hazard detection, which uses high frequency (HF) radar waves. The HF band is from 3 to 30 MHz. At these frequencies electromagnetic waves are capable of over-the-horizon propagation in the ground wave mode, so that most of the radar energy follows the curvature of the earth along the air/sea-water interface. The range of detection of surface targets is thus not limited by line-of-sight operation as in microwave systems.

SOURCES OF ICEBERGS:

The sources of the Labrador icebergs are the calving glaciers of west Greenland and, to a lesser degree, the glaciers of east Greenland, Devon, Ellesmere, Bylot and Baffin Islands. It is estimated that the Greenland ice cap produces between 10 000 and 30 000 icebergs each year. Of these icebergs only several hundred reach the Grand Banks of Newfoundland; the remainder break up and melt before reaching potential hydrocarbon production sites on Canada's east coast.

DRIFT PATTERNS:

The distance that icebergs drift from their origin on the west coast of Greenland to the coast of Newfoundland is about 1800 nautical miles and the time required averages 2-3 years. Initially, icebergs travel in the Baffin Island current and then the Labrador current south from Hudson Strait. Finally, they reach the Grand Banks of Newfoundland where they drift either eastward north of the Flemish cap (47 N) or southward between the Flemish Cap and the Grand Banks. Figure 1 presents the general drift pattern of icebergs and Figure 2 depicts the system of ocean currents in Baffin Bay, Davis Strait and the Labrador Sea that affects the transport of icebergs from Baffin Bay to the Grand Banks.

ICEBERG SIZE CLASSIFICATION:

Traditionally, the severity of the iceberg season has been measured by the number of icebergs drifting south of 48 N. This is because 48 N represents the approximate northern boundary of trans-Atlantic shipping routes passing south of Newfoundland. The number of icebergs reaching the Grand Banks varies significantly from year to year (Figure 3). For example, no icebergs were sighted south of 48 N in 1966; 1,600 in 1972; 20 in 1980; 2,100 in 1984. Figure 4 shows the average number of icebergs crossing 48 N. About 94 per cent of all icebergs cross 48 N between March to July and the remaining 6 per cent between August and February. For this reason the major iceberg season on the Grand Banks is considered to be from March to July.

ICEBERG CLASSIFICATION:

Although icebergs are irregular in shape, the International Ice Patrol (IIP) has classified the above-water part as blocky, drydock, dome, pinnacled, tabular or growler. Table 1 presents the description of each type. Table 2 and Figure 5 present the size classification of icebergs used by the International Ice Patrol and Grand Banks operators.

ICEBERG MORPHOLOGY:

Table 3 summarizes observed iceberg lengths, widths, heights, drafts, and masses in the Grand Banks region. The average length was observed to be 63 metres and the maximum was 360 metres. The average height was 17 metres with the maximum being 100 metres. The average mass was 255 000 tonnes, and the maximum was 4 000 000 tonnes. Figures 6 and 7 show the frequency distributions of these parameters.

ICEBERG DRIFT SPEED:

Iceberg speed data is estimated from radar, which is used to track icebergs on the Grand Banks. The drift speed is computed from the changing observed positions, usually about 1 hour apart. A total of 1 957 iceberg speed data points were calculated for 237 icebergs tracked in 16 drill sites over a period of 4 years (1984-1987). Table 4 presents the statistics on the distribution of the above mentioned iceberg speeds.

TABLE 4

SUMMARY OF ICEBERG DRIFT SPEED

Iceberg Speed Parameter	*Grand Banks Area*
Mean (m/sec)	0.35
S.D.	0.24
Minimum (m/sec)	0.00
Maximum (m/sec)	1.36
No. of Icebergs	237

REMOTE SENSING OF ICEBERGS:

Extensive research at C-CORE and the Faculty of Engineering and Applied Science at Memorial University over the past ten years has contributed to the development of HF radar systems as a remote sensing tool in the ocean environment. One of the primary thrusts of the initial research was to investigate the electromagnetic interaction between the ice cover and the ocean surface, and to apply this research to modelling both the signal return and the behaviour of HF radars as remote sensors. In other words, the radar returns from different kinds of targets, including icebergs, can be predicted analytically and the effects of interfering signals, such as noise and ocean clutter, can be taken into consideration.

The ice detection aspect of the research was supported by the offshore resource development industry. A device capable of detecting and tracking sea-ice and icebergs more reliably and with greater range than available surface-mounted microwave equipment was viewed as being extremely useful to offshore industry. The ice detection program initiated at C-CORE to develop that capability has investigated the theoretical models for iceberg detection with HF radar. One of the conclusions of the earlier studies was that icebergs present a sizable target for this kind of radar, and that ocean clutter was the dominant factor limiting the maximum detectable range and the minimum detectable iceberg size. Subsequent research work has led to a better understanding of the clutter signals; techniques have been developed to increase substantially the target-to-clutter signal ratios, thereby improving the range and reliability of iceberg detection.

The analytical research work was complemented by extended field experiments conducted with a commercial HF radar system. Two Coastal Ocean Dynamics Application Radars (CODAR), originally developed for ocean current measurements, were modified for experimental data collection using surface targets such as ships and icebergs. Experimental verification of the analytical models has been achieved under a variety of conditions, including rig-based operation, and has established a high confidence level for the theoretical predictions.

A new Canadian company, Northern Radar Systems Limited, has been formed to commercialize this technology. Northern Radar is currently building a prototype HF radar at Cape Race, at the south-east tip of the Avalon

Peninsula, for the long range detection of ships and icebergs, and for ocean environmental monitoring. This installation demonstrates the viability of HF radar as a reliable surveillance device under operational conditions. The flexible design of the radar will allow rapid and efficient evaluation of analytical models for target detection and tracking, and it will be used to optimize the designs of application-oriented operational systems. Figure 8 shows the location of the Northern Radar facility at the south-east tip of the Avalon Peninsula, from which it has the radar coverage capacity to be used for offshore oil-fields such as Hibernia. With a maximum range of 400 km and steerable over a 120 degree sector, the device will have a surveillance capability over a 250 000 km2 area. Figure 9 shows a more detailed layout of the radar site, dominated by the receive antenna array, which is 880 metres long . The facility is expected to be operational by July 1990, and will monitor vessel traffic and ice and ocean environmental conditions.

In addition to the large shore-based HF system, C-CORE is also involved in developing a compact transportable HF radar system for operation on floating platforms such as ships and oil-rigs. The compact size will limit the dimensions of the antenna and the directionality, i.e., there will be a higher uncertainty about the direction of a target. The motion of the floating platform and the proximity of metallic structures to the antenna system introduce other problems not encountered on a shore-based facility. These problems have been investigated and compensating techniques have been developed. The practical implementation and field-testing of such a compact system is foreseen in the near future.

FORECASTING ICEBERG DRIFT:

Reliable iceberg detection will furnish the initial data for the iceberg forecast system. These data will then be used as input for the model that describes iceberg motion and accounts for the various factors which dictate iceberg drift. Field observations and theoretical studies (e.g., Murray 1968; El-Tahan 1980; Mountain 1980) suggest that, in general, iceberg drift is affected by:

- Currents
- Winds
- Coriolis acceleration
- Waves
- Ocean surface slope (pressure gradient)
- Iceberg size parameters

The effect of these factors on iceberg drift is described in detail in El-Tahan et al. (1983) and El-Tahan (1987), and it is briefly summarized below. Currents are the prime driving force in iceberg drift, contributing about 50% to 65% of the total iceberg movement. The current is made from many components that vary significantly with time and space. Wind affects icebergs in two ways: directly by exerting force on the above water portion of the iceberg; and indirectly by generating waves and surface current. Coriolis force

is directly or indirectly responsible for the looping and spiralling motions of some icebergs. In addition, sea state can have significant effects on iceberg drift when large waves are involved. The draft of an iceberg is also affected by its size and shape. Large icebergs were observed to be influenced by deep currents, while small bergs are more sensitive to surface currents. Icebergs with high sails are more affected by wind than bergs with low sail heights. The draft of an iceberg also affects its motion. An iceberg entering an area with water depth less than its draft will be grounded until the draft is reduced by melting (El-Tahan, 1986) or overturning. Studies on long-term tracking of icebergs indicate that icebergs can be grounded for more than 70% of observation time (El-Tahan et al. 1985).

The Canada/Newfoundland Offshore Development Fund awarded a grant to C-CORE and CORETEC Incorporated to develop an operational Integrated Sea Ice/Iceberg Forecast System (IIFS). The system is based on models for regional and site specific forecasting pertaining to iceberg trajectory (ICEBERG), iceberg ensembles drift (ENSEMBLES) and sea ice edge drift (ICEEDGE) (Figures 10 and 11).

The models used to predict iceberg and sea ice drift are based on the dynamic, developed by El-Tahan (1980). The iceberg drift model has been extensively used both for hindcast analysis of iceberg trajectories and prediction of iceberg drift in support of offshore drilling operations. The sea ice edge drift model has also been used operationally during the drilling seasons 1986 to 1989.

Forces considered by the models are those due to wind, currents, waves, coriolis effects and pressure gradients. When appropriate, the models account for current variations with depth. The model predictions have been tested against field data and subjected to continuous improvements. The physics of the model are known to the extent that good predictions of iceberg trajectories can be made for periods of more than 40 hours (El-Tahan, 1980) . This can be done even under storm conditions, provided that detailed wind and current data are available as input to the model.

The development of an Integrated Sea Ice/Iceberg Forecast System (IIFS) will be carried out in three phases. The first phase will upgrade the sea ice edge model. The second phase will complete improvements to the iceberg models (individual and ensembles). The third phase will involve the conceptual design and the implementation for the IIFS. The system will also include the necessary data bases, and it will incorporate a computer data base management system.

Intensive effort, further evaluation and refinement will be undertaken before the system reaches its operational phase. Upon completion, the proposed system will be the first of its kind. It could have continuous up-dating of observed iceberg and ice edge positioning by ground wave remote sensing radar. It will provide detailed site specific forecasts suited to client needs. This venture, designed to provide an ice hazard warning system, will complement the Ice Data Integration and Analysis System (IDIAS), which is currently under development by the Atmospheric Environment Service (AES).

CONCLUSION:

Offshore operators have already recognized the significant probability of iceberg structure collisions in the Grand Banks region. Exploration drilling and production development plans incorporate ice management as an important part of the marine operations. Ice detection, tracking and ice forecasting will be critical components of such a management system. C-CORE's five year research plan addresses both topics, and it has a time schedule to produce solutions that are in conformity with industry's proposed development schedules:

i. Improvement for Iceberg Detection: basic research has demonstrated that ground wave radar will identify icebergs at over-the-horizon ranges. The work is proceeding with the engineering design to implement this research. The target is a rig and vessel-mounted iceberg warning and tracking radar.

ii. Operational Iceberg Forecasting: An iceberg drift model is being adapted to provide forecasts that predict future tracks for observed icebergs. The immediate goal is to predict tracks for 36 to 48 hours. The valid forecast period will continue to improve as forecasts for the driving forces improve.

C-CORE is committed to the integration of the results of these systems in its research. Iceberg positions and ocean wave and current maps acquired by the ground wave system will be employed to update continually the initial condition of the iceberg forecast model. The result will be the best ice information available in real time, and it will help operators proceed with safe and economical offshore resource development.

STUART AITKEN:

Thank you very much, Jack. Our third speaker in this session before the coffee break is Bill Porter. Bill is Program Manager of Oil and Gas with the Canadian Standards Association (CSA). He is a graduate in civil engineering from the University of Alberta. For some 20 years he was Manager of the industry trade association for the steel industry. He moved to CSA, six years ago.

Mr. Porter will bring us up-to-date on the very significant work that CSA has been doing in developing a code for offshore structures, which, we hope, will lead the rest of the world. Also, Bill will talk about the CSA and what is developing in the international arena on codes for offshore structures.

Please join me in welcoming Bill Porter.

BILL PORTER
Canadian Codes for Offshore Structures
International Standards Organization

CANADIAN STANDARDS ASSOCIATION

Thank you Mr. Chairman, ladies and gentlemen. I appreciate the opportunity to talk to you today about Canadian Standards Association and our standards program. There are many familiar faces in the audience, members of your industry who are actively involved in our programs. Some of you are perhaps better qualified to give this presentation that I—certainly you have more detailed knowledge. However, I was asked, and darned if I was going to pass up these Hot Springs. So please bear with me.

Since some of you probably have only passing familiarity with CSA, what it is and what it does, I have structured my presentation into four parts:

Part 1	What is CSA?
Part 2	A summary of what CSA does with your industry and a specific report on our offshore code.
Part 3	The current verification or calibration programs for the offshore code.
Part 4:	A brief summary about some significant new developments in international standards activity.

We at CSA are excited about the challenges we face in serving your standards development needs. Today I would like to share with you some of that excitement. I hope to give you an idea of where we see our role in serving you and your industries, where we stand today, and some new directions in which we are heading. But first—Why Standards?

PART 1:

Basically, a society cannot function without standards. Standards make our lives easier in countless ways. For society, having no standard for time, no weights and measures, no building requirements would result in chaos.

What is CSA? Mission statements seem to be popular these days and, of course, we had to prepare one too. CSA is an independent service organization whose mission is to provide an open and effective forum for activities facilitating the exchange of goods and services through the use of standards certification and related services to meet national and international needs.

Our association was founded in 1919 by a group of dedicated engineers in Montreal. They called their creation the Canadian Engineering Standards Association. Railways were expanding across the country, and the

first standard, appropriately, was for the design of railway bridges. From those beginnings, the association expanded to develop a full range of standards for structural engineering design. It then expanded into the electrical field by publishing the first edition of the Canadian Electrical Code in 1927—by far our best selling document. When our work began to grow beyond engineering standards, it was necessary to choose a new name—the name we carry to this day—the Canadian Standards Association.

From our early engineering base, CSA has expanded over the years to the point where, today, we are Canada's oldest and largest integrated standards, testing, certification, labelling, auditing and quality assurance organization. We are probably unique in the world in providing this full range of services. We have programs for standards covering 36 major fields of technology—in areas ranging from nuclear power, health care, medical gases, housing construction materials, hockey helmets, children's playgrounds, chain saws, tractors, etc.

First let me stress one point. The single most common misconception about CSA is that it is part of government. We are not. CSA is a private, non-profit organization, volunteer driven, largely self-supporting and governed by an independent Board of Directors. The Board itself is a voluntary consensus committee. Your participation on any of our committees means you are automatically a member of our association. CSA is organized into two divisions: the standards and certification division and the testing division. Each division responds to a separate policy board which, in turn, responds to the Board of Directors. We also have our affiliate organizations: the Quality Management Institute, and the Canadian Welding Bureau.

The standards division is now structured into nine major programs. There are five program managers covering these programs, 36 fields of technology and, hence, 36 steering committees. I am responsible for programs four, six and nine (the new program), and part of five. I am also responsible for over 400 standards documents.

Standards are written by volunteers. In this respect CSA is truly a unique organization. We owe our very existence to volunteers. I am sure may of you have worked as volunteers at some time, and you know what an immense commitment of time and energy it takes. We all have busy lives and it takes a special kind of person to give up their time willingly and frequently for a cause. The standards committees are made up of the 9 000 volunteers with specific expertise in their subject areas. They represent business, labour, government, users, and producers. These members develop and write the standards for products and services that affect us all. Membership is not exclusive. Membership in CSA is open to any individual, company or organization interested in standards activities and possessing expertise to bring to the committee table.

Taken as a whole, our committee membership represents a vast national pool of talent and knowledge. Interests of all our members are targeted on a single task—the formulation of standards that stipulate the safety and, in many cases, the performance requirements of a wide variety of products and

services. We operate under the legal definition of true consensus principles with balanced matrices in our committees so that no one faction or one side of the square can dominate the recorded votes or letter ballots. A two-thirds vote will pass a requirement.

Up to now, I have talked about the standards division. Our certification and testing division receives annually over 22 000 applications for testing and certification of products. It mandates the use of the CSA mark on over 600 million articles sold each year, and it conducts over 31 000 plant inspections annually in over 42 countries. We also have working and reciprocal agreements with other standards and certification organizations and agencies—in England, continental Europe, Japan, Israel, several countries in the Far East, Australia, and New Zealand, forming a truly global network.

The purpose of standards is to meet the needs of those in society who specify or regulate. Over half of our approximately 1400 standards documents are referenced in legislation. The rest could be called voluntary standards and are used by engineers, architects, specifiers, contractors, contractors, and so on. We at CSA are proud of our ongoing excellent relationships with both industry and the regulators. We hear from industry regularly. Members of industry serve as the backbone of our subcommittees and our drafting committees for standards. But we depend on our advisory councils to advise on the standards required by our regulators. To this end, we have had, for many years, regulatory advisory councils in these areas.

The Board is in the process of ratifying a new advisory council for the regulators of the oil and gas industry in Canada. We look forward to constructive advice from this council. There is already a regulatory authority committee, which serves as a subcommittee to the steering committee. Any recommendation from one of these councils is tabled to the appropriate consensus-based steering committee for its consideration and possible action.

PART 2:

Before reviewing some specifics of the offshore code, let me summarize the CSA programs serving the greater oil and gas interests. Basically, we have four programs under four steering committees of interest. The main one is the standards steering committee on oil and gas industry systems and materials. This covers our very mature pipeline standards and numerous other new initiatives. We also have a steering committee on offshore structures, which I will talk about later. And we have a steering committee on materials handling and distribution, which covers the storage tanks and transportation. Finally, we have the steering committee on fire safety and fuel burning equipment.

We are not the only standards development organization in Canada that may affect your industry. There are four others accredited by the Standards Council of Canada, all of which have committees and interests common to yours. Our pipeline standards program is recognized at CSA as our role model of what a standards development program could and should be—a dynamic, highly active program of over 350 expert volunteers serving on five technical

committees and 29 subcommittees and task forces. Believe me, these guys are committed; they do good work.

For the offshore program, I am sure many of you are already aware that the initiative to undertake this consensus-based design code came from discussions between COGLA and the industry. CSA was approached in late 1983, and the first meetings were held in early 1984. A long-term objective was set by the management committee to serve the development of the frontier and offshore resources; the short-term objective was to develop the offshore structures code. Hundreds of meetings later, after thousands of hours devoted to this project, we have a preliminary design code of which all of the participants in this program can be justifiably proud.

This code is state-of-the-art. It includes 13 documents—five standards, four commentaries, and four supplements to welding standards. We feel these are at least as good as comparable documents found elsewhere. At the outset, it was decided that the most current and advanced engineering theories would be utilized. There was considerable resistance to deviations from the tried and proven practices, and major concerns were expressed. The old allowable and working stress approach bowed to, for example, the limit state design (LSD), in other countries called load resistance factor design (LRFD).

LSD theory is, basically, the stipulation of acceptable levels of safety that are verified by ensuring the factored load effects do not exceed the factored resistances. Both the load effects and structural resistances are formulated by taking account of the statistical distributions of the appropriate variables—in terms of the load effects, in particular. This formulation offers considerable improvement in consistency from moving from wind load to ice load, since the significant changes in the probability of an occurrence of extreme load values cannot be properly accommodated. Suffice it to say, it is a much better basis for engineering design, and it provides a sound basis for plotting research and actual history incidents/accidents. Now even the early critics agree that the limit state design approach is preferable.

The offshore structures program was organized with a steering committee and five technical committees to actually develop the standards. The five standards documents are shown here with the technical committee chairman.

I will give a few highlights of each of these standards. They are all limit state design standards, and there are some very interesting features, particularly in the S471 and S472 standards. In S471 two safety classes are incorporated. This is stipulated, and it permits the operator maximum flexibility. The safety classes relate to possible consequences—major versus minor loss of life and damage to the environment—and specify different target values for safety for the two classes. Special attention is given to the Canadian environment, and especially to floating ice; and there is a special appendix on ice mechanics drafted by leading experts in the field.

Extreme design loads are specified in such a way that a common probability of exceedence and, therefore, a consistent safety index is obtained. This requires that, for some loading, the load factor approach is replaced by a specified annual probability of exceedence of event. This relates specifically to rare loadings such as earth quakes and icebergs. The standard considers two classes of loads, frequent and infrequent, and different design criteria are associated with these loads. Design load values to be considered in load combinations are based upon the joint probability of occurrence of load events.

S472 addresses the geotechnical engineering aspects of gravity based structures, fill structures, fill retention structures and pile supported structures. The intent of the standard is to establish essential requirements for the investigation of offshore sites and the design, construction and inspection of foundations for offshore structures. Due to the variability of site conditions, it is possible to stipulate only minimum performance requirements and to document the known significant aspects and variables. The objective is to ensure that good practice will be followed in the overall foundation design.

As in other standards, there is a clause of specific commentary, which has been prepared by the technical committee to assist in understanding the intent and rationale of the requirements and to provide initial design guidance through the use of extensive references. Because of the variability of foundation materials, codification of information has not previously been the accepted procedure. This, coupled with the unfamiliarity of some of the participants in the limit state philosophy, has resulted in an unique arrangement.

For the preliminary edition, much of the information related to partial load resistance factors remains in the commentary; thus its use would not be mandatory. We hope this confidence grows with the methodology and experiences on the variability of loads and resistances. This is happening in our verification program, as the detailed information gradually moves from the commentary to the body of the standard.

Charged with developing the standards for steel structures, the steel committee was initially concerned about whether to adopt the limit state approach. Many of the participants had their roots in allowable stress design, and they were reluctant to move from this base of known and safe operational practice. But as the discussions developed, it became clear that the world movement was towards a limit state philosophy and that the same base of safe operational experience could be correlated and incorporated.

This standard also provides a new and interesting focus for the impact of Canada's lower temperatures on the selection of steels and welding processes. Even on Canada's east coast the design temperatures reach minus 30°C and for the arctic regions minus 50°C is stipulated. We extrapolated for the east coast, which was feasible, particularly concerning the weldments and particularly the heat affected zone. Extrapolation for the Arctic was not feasible. The approach for these more severe conditions is now to use a more basic fracture mechanics approach and concentrate on toughness.

The concrete committee benefited from the extensive Norwegian experience, and their contributions have contributed greatly to this standard. The ice loading conditions in the Canadian offshore have prompted developments in the design of concrete structures related to the ability of the wall elements to resist local loads of a high intensity. Hence, the magnitudes of these local loads are uncertain, and the structure systems that minimize the costs of resisting the loads are now codified.

One unique technical committee is composed mostly of sea captains, who are used to doing things and not writing about them. The result is a performance document that is a check list of items for consideration and preparation for the load out, tow out and installation operations. It is a good quality assurance document describing the procedures and procedural documentation required for safe and effective operations. This is the only one that does not have a commentary as yet, although we are hoping this will come in the next round.

In summary, I would like to make two observations. First, the brief six year history of this code has been one of tackling many major technical issues and, by and large, the technical committees have been successful. The work also engendered significant engineering studies that are now becoming recognized as major stepping stones in the ongoing development of the civil engineering disciplines. For example, some of the concepts developed are now being applied to design codes for steel and concrete buildings. The selection of steels will, indeed, influence the design of ship hulls for future northern ice-breakers.

And second, you and your organizations have committed a great deal of money, time, resources and highly talented personnel to this program. Your faith in committing these resources to the program in the beginning has resulted in a good value for your investment.

I will summarize the costs and revenues to date. Please note that the program has incurred a significant deficit and your continued support is necessary to finalize and reach our formal standards in three or four years' time. We did not anticipate the extensive administrative time that was required for the verification program.

In closing Part 2, we seek your commitments to use these standards. It is now possible to use this design code as the basis for your engineering design, which we firmly believe will result in better engineering structures. In the long term it should reduce the risks in developing Canada's offshore resources.

PART 3:

The members of the offshore program recognized early on that the decision to adopt innovative approaches in the development of this code i.e., the limit state design, resulted in a great deal of uncertainty and a reluctance to put the code into practice, unless it was adequately tested and verified. The objectives of the program, of course, are to verify that the offshore standards

produce acceptably safe and functional structures, and to ensure that the standards are practical, usable, and that they will instil confidence in the users. Finally, the results of the verification reports are tabled back to the technical committees.

The first phase of this verification program was initiated in 1986. The subcommittee started in early 1987, serving as a subcommittee to the standards steering committee on offshore structures. Ken Croasdale was appointed as chairman and his committee consists of all of the technical committee chairmen, who, in turn, maintain the necessary liaisons with their technical committees, and recognized technical experts such as Bob Vey, Barty Stall, Ben Gerwick, etc. I think this is a most impressive gathering of expertise. That they make their time available on a voluntary basis is, we believe, indicative of the merit of this program.

The funding for the verification program is through PERD. It is administered through COGLA, and the funds come from PERD 6.2, which is marine engineering. We are now into the fourth year of the program; $450 000 has been expended and another $150 000 has been approved.

At the outset, the verification subcommittee reviewed in detail the verification or calibration needs of each of the technical committees. Specific studies were debated, budgets set and reset, and funding finally authorized. CSA has administered the program as part of the ongoing offshore program, hence the deficit; and all funding from PERD goes directly to studies.

These studies were conducted in 1987-1988. I will not take time to dwell on the titles here, but I will review them quickly. These studies were completed in 1988-1989: ice loads, load combinations and calibration of soil resistance factors. All are major contributions to the technology, and a lot of the work is now being discussed by the technical committees for revisions to the standards. The 1989-1990 programs were designs studies and calibrations, etc. The 1990-1991 programs subcommittee is in the process of reviewing verification studies, and these are the projects—some already approved and some proposed. We hope that the major design studies noted in the bottom two before the last will receive some industry funding, and there is some possibility that ESRF funding may be applied to these final shadow design studies for typical steel and concrete structures.

A great deal of work remains to be done, and these future verification studies are under consideration. As you can see, the verifications subcommittee has had a lot to think about. I think they have done an amazing job of pulling out lot of bang for the buck.

PART 4:

We at CSA perceive our role as a facilitator in serving the standards and certification interests of the stakeholders in Canadian industry. The objective is, of course, to ensure that you, the users of these standards and these qualification and assurance services, are served by the best programs possible.

In this regard, we have recently initiated a liaison role with the International Standards Organization. The ISO's technical committee #67 (ISO TC 67) is responsible for the international standards for the oil and gas industry.

In the standards field, ISO has quite suddenly taken centre stage. Why? I believe that with the significant level of standards development activity being generated by ECC 92 and the policy of the European Community to recognize or give preference to ISO documents, there has been renewed interest in international standards development activities in the United States and other countries.

Although ISO TC 67 has been in existence for many years it has not been a particularly active program. The main secretariat was held by Romania, and North American participation had by and large been non-existent. In 1988, Romania decided to abandon the secretariat, and the American Petroleum Institute resolved to table all of their standards documents for consideration for adoption as ISO standards.

They directed this through the American National Standards Institute (ANSI), which in some respects acts similarly to the Standards Council of Canada—although it is a non-government body. ANSI now holds the secretariat for the main technical committee of ISO TC 67, although it is our understanding that the administrative functions are being handled by API staff. The new ISO technical committee has met twice, most recently in February. It will meeting in June 1990 in Oslo, Norway. Several subcommittees have held meetings.

What has transpired to date? Basically, a task committee has reviewed all the API standards documents and grouped them into three categories. The first category concerns those standards that are unlikely to be opposed as ISO standards. The second category are those that should be reviewed by a subcommittee or by the voting members of the technical committee prior to adoption. And the third are those that would require more detailed consideration prior to a letter of balloting and adoption.

The standards in category one, or fast-track adoption mode, are now being circulated for a letter of ballot to the ten member countries of ISO TC 67. These include such standards as down-hole technology standards, well head standards, etc.

Where does Canada fit into this? First, let me point out that the vote at the ISO committees is by country. By legislation, the vote for Canada is held by the Standards Council of Canada and can, therefore, only be delegated by the Standards Council. The Standards Council operates on the basis that a Canadian advisory committee is set up to parallel each ISO technical committee. There has been a Canadian Advisory Committee to ISO TC 67 for many years, although this has largely been pipeline interests. Chairmanship, in recent years, has been held by Mr. Jim Justice of TransCanada. He chaired the most recent meeting of the CAC in conjunction with the CSA pipeline technical committee in November 1989.

The ANSI/API developments were thoroughly discussed, and it was resolved that the significant Canadian interest was to place our recent offshore structures designs code on the table for consideration on an equal basis with the API RP2A design standard. The pipeline members felt that the current direct liaison with API pipeline technical committees was adequate to ensure that the Canadian needs for pipeline technology were represented in the development of the API and the ISO documents. At the close of this meeting, Mr. Justice tendered his resignation, and it was resolved that the chairman would come from the offshore program.

A special task group of the steering committee for the offshore program met early this year. It was resolved to proceed with formalizing a liaison with the ISO TC 67 and to request that our offshore standards be considered in the offshore program. This has now been done. Dr. Peter Adams, president of Technical University of Nova Scotia and chairman of the CSA standards steering committee on offshore structures, has agreed to serve as the new CAC chairman and to present the Canadian oil and gas industry's interests at the forthcoming ISO TC 67 meeting in Oslo, Norway May 30th—June 2nd.

These ISO developments represent a truly great opportunity for Canadian oil and gas interests to influence significantly the development of international standards and to provide a forum to ensure that specific Canadian needs towards meaningful standards requirements are addressed in these international subcommittees and this technical committee. As the decision-makers and policy-makers in the Canadian oil and gas industry, you need to understand and be aware of the opportunities in this trend towards the development of international standards development and the potential disadvantages to your suppliers and service industries.

CSA stands ready to serve and assist in maintaining a watching brief and to administer a program if it is deemed necessary. But there is, as always, an associated cost. Working with Langley Muir, we have submitted a preliminary proposal to the federal government for support of such a program. Hence, ladies and gentlemen, the ball is in your court. If you wish to participate in the ISO developments, we commend your consideration. We feel fairly confident that if there were a commitment from industry, there would be government support for these activities.

In closing, let me emphasize the high regard and respect that we—as administrators of your standards development programs—have for the stakeholders in these programs. Your firms, your industry and government representatives have clearly demonstrated firm financial support and tremendous wealth of technical expertise at the committee tables. We believe the standards we maintain in these areas are truly a world class document. They are also a credit to the consensus process and your concerns that the investments are technically sound and safe. Our compliments to you. Keep up the good work.

SESSION VII

PRODUCTION SYSTEMS

INTRODUCTION

BY STUART AITKEN

In our final session this afternoon we are going to talk about developments that have occurred in the way we look at production facilities. We will try to address the cost element of production facilities and what has happened since many of us met here two years ago. We will look at some of the experience in the North Sea and the reactions there to the dramatic drop in oil prices and to the safety issues brought dramatically to the fore by the Piper Alpha disaster. We will look at some new developments in technology applicable to the Beaufort. And for those who are very cynical about the idea of bringing it to market and those who think they have perhaps watched this tortoise for long enough, we will finish up with perhaps the hare that is going to win the race, when we look at the plans to develop the Cohasset/Panuke fields off Nova Scotia.

Our first speaker this afternoon is Renger Biereman. Renger is with Shell International at the Hague. He obtained an MSc in civil engineering from the Technical University of Delft in 1973, and joined SIPM as Offshore Design Engineer. From 1974-1979 he was involved in construction and project engineering in Gabon and Brunei. He then went to jackup design work for Gorm in Denmark, and the troll platform design work with Noscar Shell. In 1985 they took him across the other side of the water to Shell Expro as Chief Engineer on the Kittiwake program. Since 1988 he has headed the Marine Technology Section with SIPM in the Hague. Please join me in welcoming Renger Biereman.

RENGER P BIEREMAN
Head Marine Technology
Shell Internationale Petroleum Mij.

NORTH SEA DEVELOPMENTS 1985-1990: A SHELL PERSPECTIVE

North Sea offshore developments in the second half of the eighties have undergone some drastic modifications. The first of these changes was triggered by the collapse of crude oil prices in early 1986, and led to a dramatic change in the way Shell companies carry out their business in the North Sea. The second major set of changes result from the Piper Alpha disaster, and lead to a review of and changes to existing practices within the North Sea oil and gas industry.

This paper discusses the most significant consequences of the above events on North Sea operations, using the experience of Shell UK Exploration and Production (Expro), the operator for the Shell/Esso joint venture in the UK sector.

CRUDE OIL PRICE DEVELOPMENTS:

Following the two drastic increases in world crude oil prices in 1973 and 1979, a gradual erosion of prices took place in the early eighties, particularly when expressed in real terms, as shown in Figure 1. Shell companies realized that the supply and market situation was subject to intense pressure, as OPEC's share of the shrinking world market declined at the expense of increasing non-OPEC production. Development plans for new fields were reviewed in 1985 to assess sensitivities to oil prices considerably lower than the US $30-35 per barrel prices at that time.

This led to a re-analysis of Shell Expro's Gannet project in late 1985. As a result of this second look, the plans were modified from a large US $3.5 billion cluster development, involving one central drilling and processing centre with three satellite platforms, to a phased development where each field would be developed with a stand-alone facility. Capital and operational costs were similar, but the risk in the phased development was much reduced.

The oil price drop occurred soon thereafter, and prices plunged to lower levels than projected in the 1985 exercise. As a result, the phased development of Gannet also became uneconomical. In addition, the Tern and Eider projects, which were in the transition phase from design into fabrication, became marginal, and intense reviews took place to reduce costs while fully retaining safety standards. Both project teams were successful in identifying a number of major savings, maintaining the profitability of these two developments.

PROJECT EXECUTION CHANGES:

Project Team Sizes: Shell Expro's structure for executing projects was extensively reviewed, and led to slimming-down of project team sizes, making the design and fabrication contractors truly responsible for managing their business with the client and for taking more of a monitoring and auditing role than before. Initially the message was not always believed, and fabricators, for example, still expected Shell Expro to supervise inspection staff. The new quality approach required a determined effort on the part of the contractors to have their own project management tools in place. Shell Expro stopped developing detailed networks of design and construction activities, and started to rely on documentation (execution, quality, and safety plans) produced by the operator, who is expected to work to the plan that he himself prepared.

The size of Shell Expro project teams on large fabrication contracts (10 000 tonnes topside facilities) now averages around twenty (during onshore commissioning additional operations staff are brought in). The small construction site teams (compared to eighty staff employed by some of our competitors on equivalent contracts) result in more cost savings because the contractors do not feel obliged to field one man for each of the clients. So instead of saving one man on your own team, you save two men for each position. Additional cost savings are accrued by minimizing bureaucracy and improving staff efficiency and motivation. Each individual carries a greater responsibility, thus enhancing the individual's output and job satisfaction.

Front-end Definition: Until the mid-eighties the priorities on offshore developments were often driven by schedule considerations. The emphasis on achieving first oil often outweighed proposals to continue studies to optimize the design further. This was caused, in part, by applying the high discount factors (favouring early first oil) to internal project optimization (concept comparisons, capex/opex trade-offs, extent of sparing, deferred production, etc.), which are used as investment criteria to develop the field. The latter include a wide range of uncertainties, among which are oil prices, politics, geology, inflation, etc. However, when considering the effects of delay, reduced up-time, etc., many uncertainties no longer form part of the decision, as they remain equal for the options considered. This has led Shell companies to adopt lower discount rates for internal optimization, aiming towards the level of post-tax cost of money.

The result is that cost reduction has become much more important than before. Project economics often improve markedly by further optimization at the expense of a delay in start-up. It has also de-emphasized the importance of sparing. Many components are no longer spared in new designs. As outlined later in this paper, this has very positive repercussions on the safety and operability of our installations as fewer people are needed offshore to maintain the facilities.

In the most important change, managers actively encouraged engineering staff to challenge existing practices, by making suggestions for better and simpler engineering that resulted in cost savings. This practice generated a host of ideas, many of which have since been incorporated in new projects.

Shell project teams now spend additional time at the initial stages to produce the optimum field development plan, and they have petroleum engineering and operations staff (production maintenance and drilling) in their front-end team to ensure there is full integration of the requirements for all disciplines. Operations staff retain weekly contact with their own organization to ensure that ownership of the design is obtained from the future operators as early as possible. This avoids the (traditional) long wish-list of modifications the operators want when they receive the facility from the engineers.

The Shell front-end teams work virtually without contract staff. Conceptual designs are done in-house to achieve maximum synergy, provided sufficient in-house staff is available. By using Shell staff to design rather than supervise the conceptual design by a design contractor, maximum use is made of the talents of our highly qualified engineers. They are intimately familiar with the Shell objectives, and are in a much better position to challenge and to balance requirements of the different disciplines involved in oilfield planning. The design contractors are brought in to do the detailing, which involves a ten-fold increase in man-hour activity. This formula, in our opinion, assures success, as we believe we are better at integrating all the various discipline requirements represented in an oilfield, whereas the design contractors are organized best to execute the detailing of a pre-determined concept involving a large number of man-hours.

TECHNICAL DEVELOPMENTS:

Evolution of Offshore Platform Concepts: As oil prices dropped in 1986 and oil companies were reviewing their portfolio of future projects, the offshore construction industry, in anticipation of a continued boom in offshore activities, had made some investments that would assist in reducing project costs sufficiently to rebuild confidence. Four semi-submersible twin crane vessels with capacities in the 7000 to 14 000 metric tonne range were now available in the market, facilitating a breakthrough in offshore structures design. All Northern and Central North Sea jacket structures up to that time had to be launched, and the topside facilities had to be built in several modular components, to be hooked up offshore. The heavy lift vessels allowed the vast majority of the structures to be lifted, eliminating the need for launch frames and buoyancy tanks and reducing the wave/current platform loading in the process. The slimmed down topside facilities can now often be fitted inside a single liftable integrated deck instead of the traditional module support frame and modules arrangement, reducing offshore hook-up largely to the top-side/jacket interface.

For a medium-sized stand-alone field development in the Northern North Sea, a launched jacket of 20 000 tonnes (Figure 2—Tern substructure) can now be reduced in weight and size to a lifted structure of 10 000 tonnes without loss of topside load carrying or conductor capacity. The associated topside facilities have substantial cantilevers and feature centre-bay drilling. While installation costs for the jacket are similar for both types, the reduction in steel weight allows an overall cost reduction of some 40 per cent. The savings in topside costs by adopting integrated decks are also substantial. Weight savings of some 10 per cent and hook-up cost savings around 50 per cent (the difference between offshore and onshore hook-up) lead to overall cost savings of around 20 per cent for topside facilities. Furthermore, the reduced offshore hook-up time leads to earlier oil or gas production.

Kittiwake Development: As indicated earlier, the plans for the Gannet complex of fields (including Kittiwake) had become uneconomical with the 1986 crude oil prices. The phased development plan featured two major investments made during the first field development for the benefit of the others to follow: a mobile self-contained drilling module, and a pipeline linking the first development (Kittiwake, Figure 3) with the Fulmar storage and export system 150 km southeast.

The Kittiwake drilling facilities have since been designed to be fully integrated with the processing facility, i.e., sharing electrical power, as well as air and water utilities. No separate dedicated emergency power is available for drilling as was previously the case on Shell Expro platforms. The oil export system consists of the ex-Auk loading buoy, with DP tankers remaining connected until they are full. This may take three weeks during plateau production and can take several months towards the end of field life. Loading system uptime will probably be around 98 per cent, as experienced in Norway with similar systems. The integration of drilling and processing utilities and tanker offloading reduced costs by 15 per cent.

Incorporating all facilities, with the exception of the living quarters and the drilling mast, in a single integrated deck, which is liftable by the equipment of the three offshore installation contractors, and virtually eliminating sparing resulted in a further 10 per cent saving in project cost. Improvements to the design of the lifted jacket resulted in savings of 2 per cent. Improvements in drilling performance, lower drilling crew rates and a reduction in the number of wells from 11 to 10 saved a further 5 per cent.

By adding the benefits of a smaller project team size, and applying lower than historical contingency levels, the total anticipated cost saving became 40 per cent, equal to $300 million below the original estimate of $800 million.

Minimal changes during subsequent design and fabrication and tight weight control resulted in a platform that was 5 per cent lighter than projected on the basis of historical project performance. The project also benefitted from a favourable buyers market, because no other major projects were approved in 1987. This allowed the best contractors to be hired, and, responding to the spirit of mutual trust and hands off approach by Shell Expro, all contractors performed well with improved output. Initiatives to improve the safety performance of the fabrication contractors were also successful. Overall, a 30 per cent reduction in the lost-time injury rate was achieved. The combined effect of these achievements suggests a final project cost around $425 million, close to half the original estimate back in 1985. It will be difficult to repeat this performance today in a North Sea market, which is becoming tight in terms of design and fabrication resources. This is despite the considerable productivity improvements made in recent years by the UK construction industry.

SIPM INITIATIVES:

While the Kittiwake oil and Sole Pit gas projects in the UK were maturing, the engineering function in Shell Internationale Petroleum Maatschappij's Exploration and Production Co-ordination in the Hague (SIPM-EP)—the service company unit responsible for giving technical advice and support to Shell E&P companies around the world—reviewed the Shell companies' worldwide portfolio of discoveries. SIPM-EP set up the SLIM (Simple Low-cost Innovative Marine production systems) task force to assist operating companies in reducing development costs by a further 25 per cent relative to the Kittiwake/Sole Pit types of development. The review indicated that most fields were small in size (less than 100 million barrels equivalent), and were within 50 km of existing infrastructure. The review highlighted that cost reductions in the order of 30 per cent would increase the volume of economic reserves by approximately 50 per cent, as shown on Figure 4.

Satellite Development and Multiphase Technology: One solution to achieving economical projects for these smaller fields lies in the development of multi-phase satellite technology and using the existing oil and gas processing and export infrastructure. Shell companies, being in a favourable position with a large infrastructure in the North Sea, anticipate most of their offshore developments during the nineties to be satellites to these facilities. Examples of

this approach are the subsea developments Osprey to Dunlin (start-up late 1990), and Gannet B, C and D to Gannet A (start-up late 1992). A total of some 100 subsea wells are currently expected to be drilled in the coming decade.

The satellite technology is therefore regularly applied by Shell companies, but not to the scale and distances that will be required to develop the full portfolio of discoveries. Ultimately, we are aiming to develop fields at large distances (50 km or more) with a single bulk flowline, providing metering facilities near the wellheads (subsea or on unmanned satellite platform) and adding energy to the wellstream either at surface, subsea or downhole. Since 1986, Shell companies have been very active in sponsoring a number of multi-phase initiatives.

In addition, the Shell laboratory in Amsterdam (KSLA) has developed prediction tools for corrosion rates, which quantify corrosion suppression by glycol in mild C02 environments. This has led, for example, to the adoption of untreated wellstream transport for the Troll Field to an onshore process and compression plant. Norske Shell have sponsored a number of booster pump developments by Framo engineering. The Shell Multiphase Underwater Booster Station SMUBS (Figure 5) has undergone extensive testing, and Norske Shell has proposed its use to the partners in the Draugen Field.

An advanced electrical submersible pump (ESP), based on an extension of pump technology applied for years on crude carriers, is now being tested in an oilfield application in Oman. This pump design is much more robust than conventional ESPs, and is expected to achieve a minimum (not mean) time between failure (MTBF) of two years. As most of the fields are gassy, and as maximum benefit from multiphase boosting is achieved by lowering wellhead pressure as much as possible, the technology needed is really a liquid tolerant compressor and a gas tolerant pump (Figure 6 showing gas function as a function of GOR and suction pressure). Two initiatives are being pursued: a contra-rotating booster and a disc compressor that can boost fluids with gas fractions of 98 per cent and above. The contra-rotating pump will soon be tested in the Netherlands, and the disc compressor is in the design phase.

The SMUBS in Draugen is driven by water power available from the water injection system. Over longer distances electric power will be required. Framo is also active, as are others in the industry, in developing suitable connectors. In our view AC electric power in the range of 1 to 5 MW, with frequency control to vary the motor speed, can be transported over distances up to 50 km without the need of DC/AC conversion.

The Multiphase Systems Plc (formerly Stothert S: Pitt) screw pump is undergoing testing in Sarawak on the Bokor platform. This unit is not readily suitable for subsea use because of the bulkiness of the skid, but within its operating limits is an alternative for platform applications.

Alternative Platform Concepts: The SIPM-EP review identified that concrete platforms, steel monotowers with triangular support, and jackup units all could be competitive with the latest generation of lift-installed jackets.

Examples of this competitiveness are the Hamilton Brothers' selection of concrete for their Ravenspurn development and Unocal's use of a mini-TTP in Dutch waters. (Figure 7 shows a concrete platform alternative for Kittiwake). Shell Expro is now considering concrete for Galleon and Nelson; NAM is adopting concrete for the F3 development. Steel monotowers with triangular support (Heerema TTP and Maersk's STAR) are competitive when a limited number of wells is needed; and jackup units like the TPG5OO can be competitive with conventional steel or concrete production/drilling units. So far no jackup development has been announced.

Safety Considerations: By reducing the sizes of our offshore facilities, and by minimizing or virtually eliminating sparing, the operations and maintenance effort is substantially reduced. Some increase in downtime is obvious, but often its economic effect is less than the benefits achieved from lower capex and opex, while improved safety is achieved through less exposure offshore.

Reviewing Shell companies' E&P worldwide fatality statistics for 1978-1989 (Figure 8), it is worth noting that only 7 per cent of fatalities have occurred as a result of fires and explosions. Most of the fatalities are in transport (the Chinook disaster off the Shetlands) and accidents that occur during construction and operation.

Shell companies have, therefore, adopted an approach to safety in the design phase that takes into account the safety aspects of all project phases. Many in the industry have tended to zoom in solely on the drilling and production phases, "forgetting" about the other phases as indicated in the matrix in Figure 9.

The SLIM team compared a number of manning options for a site specific stand-alone development in UK waters. The options considered were:

i. totally unmanned, with maintenance crews flying in from the coast on an "as needed" basis

ii. normally unmanned, but maintenance crews staying overnight during trips

iii. minimum permanent crew, but with limited safety facilities on the platform

iv. conventional set-up, with manned installation and the full suite of safety facilities in accordance with the current regulations and company practice

Comparing the risk levels to personnel over the field life time for this specific site, the smallest potential loss of life option turned out to be the third (Figure 10). In this option, to minimize maintenance and offshore manning levels, safety facilities are reduced from double or triple redundant fire-water and deluge systems to a single system, and many detection systems are deleted. This design allows for staff to have a safe haven for two hours (or less, in the event that inventory release is of a shorter duration), and adopts a so-called

"burn-down" philosophy for the hardware. An overall statistical loss of life reduction of 40 per cent could be achieved by this approach versus the conventional manned platform option.. The unmanned solutions also appear attractive until the risks to the individuals are considered (Figure 11). The extensive exposure to helicopter flying from shore makes these unmanned options undesirable in our view. While a small reduction in risk can be achieved for the individuals on the platform, by adopting the conventional design approach with the full suite of safety features, we, on balance for this specific site, would support the minimum permanent option in view of its significantly improved overall loss of life performance.

Environmental Considerations: The increasing concerns about the worldwide deterioration of the environment also affects our industry. One common goal is to "all do better" as the mistakes and mishaps of one company will hurt us all. There is no competition here; we are in it together as operators. Shell companies have set ambitious targets ultimately to eliminate all discharges with an adverse impact on the environment. Task forces have been appointed to review the fundamental way we operate with the aim to see whether ways can be found to process hydrocarbons without the use of harmful chemicals and emission of waste materials into the environment. An ambitious target, probably, but we are prepared to put some of our cleverest researchers and operations staff on this effort, and will give them the resources they need.

On some of our latest offshore developments environmental issues have had a major contributing impact. NAM'S F3 dry cell concrete platform is considered to be the environmentally best development option, and the Troll onshore scheme was selected partly because it features substantially less CO2 and NOx emissions than the offshore alternative.

PIPER ALPHA:

Kittiwake Re-assessment as a Consequence of Piper Alpha: Piper Alpha and other accidents demonstrated a number of weaknesses in the oil and gas industry. While some hardware improvements might have mitigated the disaster, it is obvious that a larger problem existed in the planning, management and verification of our activities offshore. We use a large number of contractor staff, and the training of contractor and our own staff to adhere to the (large number of) procedures is no easy task.

Streamlining or slimming down and improving the user-friendliness of procedures are key to enhancing the safety of our installations. We prefer that the users write the documents, not some (professional) editor in an office far away from the worksite.

When the Piper Alpha disaster occurred, SLIM initiatives had been underway for some time, but (obviously) the earlier generation of platforms had not benefitted from the insights obtained. Kittiwake had been designed with the benefit of the explosion research results achieved at the Shell Thornton Research Centre in the UK in the eighties. The results had been applied to demonstrate that centre-bay drilling featured slightly smaller overpressures than

the end-bay arrangement, while radiation levels in the safe haven were similar for both cases. Fire and blast walls had been designed using plastic analysis techniques and on the basis of the projected (maximum) overpressures of the Thornton models.

When the Piper Alpha accident occurred, the Kittiwake design, as all other platform designs, was reviewed to identify any possible deficiencies or areas for improvement. It was encouraging that only a limited number of minor improvements were identified on Kittiwake, e.g., increasing the fire rating on some of the combined blast/firewalls and the living quarters support frame from A60 to H60, and relocating the ESD valve on the gas export line to a location that is not prone to damage from an explosion.

Safety Approach: For Shell Expro's existing platforms, extensive studies are ongoing to design improvements needed to enhance safety and to extend the platforms' lifetimes. A number of incidents have recently occurred on Shell Expro's North Sea platforms. In each instance the safety devices have worked as planned following hydrocarbon leaks and explosions, containing the incident to (substantial) mechanical damage without loss of life.

Shell companies consider protection of life to be paramount in our offshore environment. This implies that a safe haven is required where our staff can muster should events on the platform require evacuation. A design minimum of two hours protection (or less, if release of the total inventory is achieved in a shorter period) is established to allow evacuation by helicopter or, when weather conditions do not allow, by lifeboats. The safe haven should be sheltered from events like jet flames. In the event that release from major pipelines could cause the integrity of the haven to be jeopardized within this timeframe, installation of subsea ESD valves will be considered. An important factor in the decision process will be the risk of installation of the valve(s). This must not pose a greater risk to life than the projected benefits. The effectiveness of such ESD valves is being assessed by quantitative risk assessment (QRA) techniques taking into account the probability of the failure, the consequences and the chance of successful intervention with an ESD valve.

Joint Industry Initiatives: To obtain full industry consensus on the safety design practices for offshore installations, a joint industry project has been set up by the Steel Construction Industry (SCI), Thornton Research Centre, Shell Expro and British Gas, together with expertise from BP, TNO and Wimpey Offshore. The Department of Energy is sponsor, and regards this initiative as one of the most important undertakings by the oil industry to prevent accidents similar to Piper Alpha. Shell's Thornton Research Centre and British Gas have both done extensive experimental work on explosions, and they are making their pool of expertise available to this vital project. Additional know-how is sought from other well known sources like the Christian Michelson Institute in Norway (which has carried out the blast/firewall designs on Norske Shell's Draugen project). This project is expected to obtain broad support from the North Sea operators.

The JIP is split into two phases, with the first phase being a collation review and appraisal of existing knowledge. The second phase, as yet not defined, will address any knowledge gaps identified in phase one. Interim guidelines will be produced at the end of phase one, which may then be used by participants until the phase two work has been completed. Total budget value for the project's phase one is US$ 1.4 million.

This project demonstrates that there are no secrets in safety, and that Shell and other companies are prepared to share their knowledge with others in the industry for the benefit of all. It is anticipated that the results will lead to common safety standards throughout the industry. The task at hand is very much a common one with regulatory bodies, oil companies and research institutions working towards one goal.

The project is not a research exercise. It is an industry project aimed at the creation of very practical and realistic guidance for practising engineers engaged in offshore operations.Another initiative where Norske Shell is active is the pursuit of safety improvements in helicopter flying. This joint industry effort already has identified several risk factors, which have a major impact on safety and which show potential for marked improvements. Future research is planned in reliability and maintainability management, external navigation aids and services, crash worthiness, design for emergencies, and pilot performance with regard to working conditions, which will be required to reduce the risk associated with helicopter transport.

Technical Integrity Practice: Following the North Sea accidents, SIPM-EP has developed a methodology that logically and visibly provides a guideline to prepare platform layouts in a way that optimizes its technical integrity, and minimizes risk to life, environment and assets. This method contrasts with existing industry practice where the crucial lay-outs are left to the chief piping draughtsman in the design contractor's office. This experienced designer is generally very competent to lay out the facilities in a fashion that optimises pipe and cable tray runs. However, he or she is rarely intimately familiar with the deliverables of quantitative risk assessments and operational and maintenance requirements of the equipment, which are all factors needed to achieve a layout with the necessary degree of integrity and operational convenience.

The methodology developed by SIPM-EP is hierarchical in approach, and provides an audit trail throughout the process. It starts with an assessment of platform functions such as drilling, gas processing, gas compression etc. (Figure 12 —function group analysis deliverable diagram for a centre-bay platform arrangement). The function groups are arranged in an iterative process to minimize the likelihood and effect of an incident in one function on the other(s), while, at the same time, making due allowance for operational needs, and enhancing operational efficiency.

The second step is to identify within each function group any sub-group(s) that would be incompatible with the function group as a whole. The method identifies potential alternative locations for such sub-groups, which

must then be reviewed using engineering and operational judgment to determine their acceptability.

Having allocated all function sub-groups to acceptable locations, the next step is to position equipment blocks—groupings of hardware that are, for purposes of layout, indivisible—first, based on the likelihood of their either initiating or reacting unfavourably to an incident, and second, based on their space requirements.

The fourth step examines whether the proposed layout implies extravagant interconnecting piping, and identifies undesirable features such as crossing of the wellbay by hydrocarbon piping.The final step in the process is merely the acknowledgement that other studies (e.g., explosion mitigation) and project reviews (by senior engineers and operators) may prompt further reviews of the procedure, in order to arrive at an optimum solution.

This process can be used systematically to position all equipment with a high maintenance load on one level, facilitating the tasks of the maintenance crews, particularly if workshops are positioned at the same floor level. The technique will also lead to a layout which will feature the lowest practical risk level, as QRA methodology is very much part of the approach. Most importantly, the technique provides a logic to incorporate the input from all the engineering and operational disciplines in a transparent and integrated fashion.

CONCLUSION:

To cope with the unprecedented challenges of a collapse in oil price and the largest disaster the North Sea oil and gas industry has ever faced hasn't been easy, but we have come out a lot stronger. In 1986, who could have predicted the current level of development in the North Sea with prices still below US$20 a barrel? It is a credit to our engineers who devised ways to develop the marginal fields more cheaply, and safely and with less impact on the environment. A major task, however, is to restore the public's confidence from the lows so clearly exemplified in your part of the world by the Valdez oil spill. We can't for one moment drop our vigilance, and we need to strengthen the responsible role we play in society. While it is perhaps still a dream, our ultimate aim should be to eliminate any adverse impact of our activities on the environment. It will have a price tag, but our projection is that it is well worth the effort. We plan for it!

STUART AITKEN:

Thank you Renger. Our next speaker is Charles Yu, who will bring us up-to-date with some developments on designs of structures for the Beaufort. Charles graduated in aeronautics, if you can believe it, from Imperial College in London, where he obtained his MSc in 1975. He then worked for Lloyd's Register of Shipping and in Britain and Norway on research and design related to offshore structures and production platforms. He came to Canada in 1981. He worked initially for Petro Canada, before joining Gulf in Gulf Canada's frontier department in 1983. Currently he is Supervisor of Structures, responsible for

Gulf Canada's structural activities and projects in the Beaufort Sea, Canadian east coast and other international offshore areas. Please join me in welcoming Charles Yu.

CHARLES YU
Supervisor of Structures
Gulf Canada Resources, Ltd.

PRODUCTION SYSTEMS FOR THE ARCTIC

Recovery of hydrocarbon resources from the Canadian Arctic demands platform structures that will survive the severe ice climate. The exterior walls of these oil and gas production structures will be subject to large concentrated ice forces. Composite steel/concrete construction has been proposed as a cost-effective solution in resisting these forces. Such composite systems are being developed by various organizations in Canada, the United States, Japan and Great Britain. The development work to date has shown composite members to have high flexural and shear capacities and to exhibit very ductile failure modes, resulting in a large capacity to absorb energy.

The potential for composite construction in ice-resisting wall systems is great. Conventional, all-steel ice-resisting walls are composed of heavily stiffened plate panels requiring an extensive amount of labour-intensive welding. Conventional, reinforced concrete ice-resisting walls are composed of thick sections containing a high percentage and complex arrangement of reinforcing and pre-stressing steel. This construction method is also labour intensive, requiring the difficult placement of highly congested reinforcing bars. Composite wall systems eliminate many of the high cost details associated with these two conventional wall types.

This paper will look at the design considerations and advantages of composite construction. General details and testing of selected state-of-the-art composite wall designs will be discussed. Finally, results of the work effort to confirm the constructability and cost-effectiveness of a composite ice wall system for the Amauligak CRI production platform will be given.

HISTORICAL BACKGROUND:

The environment that characterizes the arctic Beaufort Sea is one of the most severe that can be encountered anywhere in the world. Ice is the primary constraint in the area since it is present at least nine months of the year.

Offshore oil and gas production structures proposed to operate year round in this harsh arctic environment must be designed to resist very large, concentrated ice loads developed by formidable masses of solid ice, in a safe and efficient manner.

To date, both concrete and steel ice-resisting peripheral walls have been used in various kinds of arctic offshore structures to withstand these extreme local ice forces.

As a basic material, concrete offers many advantages in an arctic environment. However, the application of conventional design practice to extreme ice loads has resulted in concepts with massive structural sections and a high percentage and complex arrangement of reinforcing and prestressing steel.

The construction method is also labour-intensive, requiring the difficult placement of highly congested reinforcing bars. Other drawbacks include the difficulty in securing water-tightness, once concrete cracking develops in the structure as a result of interaction between the ice and the structure.

Conventional, all-steel, ice-resisting walls are composed of heavily stiffened plate panels, with the skin plate spanning between closely spaced T-ribs and the T-ribs spanning between closely spaced bulkhead frames. An extensive amount of labour-intensive welding is required.

In an effort to find cost-effective solutions to the design of ice-resisting walls for these Arctic structures, composite steel/concrete walls have been proposed. The general structure of a composite ice-resisting wall, as shown in Figure 1, consists of outside and inside steel plates, fastened together with diaphragm plates (or by some other mechanical shear connectors), and concrete fill in between.

While composite construction, comprising concrete decks connected to steel beams, has been used successfully in bridges and high-rise floor slabs for many decades, the form of construction utilizing steel/concrete/steel sandwich composite has little precedent.

Exploitation of this form of composite design technology is, therefore, limited by the lack of an accepted design methodology and relevant test data.

In early work reported by Japanese researchers in 1977, sandwich composite was shown to be able to resist high local loading. It was reported that arch action through the concrete was primarily responsible for this high capacity, as shown in Figure 2. Subsequent published research has confirmed and extended the Japanese findings. During the past five years, numerous proprietary joint-industry studies have extended this early work on sandwich composites. These include research and tests by ABAM Engineers, Shimizu, C-FER, Ben C. Gerwick, Inc., etc. Gulf Canada was a key and active participant in all of these developments.

DESIGN CONSIDERATIONS:

If a particular composite wall design is to be considered for use in an offshore structure, it must satisfy three basic requirements:

i. Strength: the wall must possess sufficient capacity in both flexure and shear to resist very high ice loads.

ii. Ductility: following a local failure, the wall must possess strength through large deformations to ensure the prevention of a progressive collapse.

ii. Economy: details of the wall must be sufficiently simple to reduce the fabrication and the construction costs by an amount significantly below the costs for a conventional steel or reinforced concrete wall.

In developing composite wall details, the last of these requirements must always be kept in mind. If a composite wall design satisfies the first two criteria, but not the last, a conventional design will undoubtedly be used.

ADVANTAGES OF COMPOSITE CONSTRUCTION:

The steel hulls of ice breaking ships and exploratory drilling platforms have experienced denting of the exterior plate, buckling of scantlings (stiffeners) and, most serious of all, buckling of bulkheads, due to high local ice pressures.

On the other hand, composite construction can efficiently resist local buckling by arch action and membrane compression in the concrete and shear reinforcing steel. This, in turn, enables longer spans between interior frames or bulkheads, which are a major cost and weight item. The required thickness of exterior steel plate is also reduced, since local stiffness is provided by the concrete backing. This, in turn, reduces fabrication costs and the demands on plate ductility and through thickness properties, as well as facilitating better quality control.

Composite structures are not subject to brittle modes of failure at low temperatures or under high rates of impact loading. Of special importance, properly designed composite structures can exhibit very high shear and flexural strength, as shown in Figure 3. This figure shows the results of a punching shear test on a typical composite wall element, as performed by C-FER. The test illustrates that for the wall type they were testing, it was not possible for an ice load event to generate a punching shear failure.

Furthermore, composite wall elements can be designed to exhibit ductile, energy-absorbing modes of failure when a flexural failure occurs. It has been shown that ductility can be achieved even when a shear failure occurs, provided the concrete is sufficiently confined (Figure 4).

Composite construction permits the prefabrication of standardized double-wall sections in a ship yard or slipway and their jointing and launching by conventional facilities, thus making a construction basin unnecessary. The double hull section may be launched and then the concrete fill placed while the structure is afloat. These aspects, combined with the overall lighter weight of composite construction, make it practical to construct gravity-based structures in relatively shallow harbours. Figure 5 shows one of Gulf Canada's proposed Amauligak CRI barges, based on the composite option, prior to launch.

When water tightness or oil tightness is a concern, the steel plates will span any local cracks and prevent in-or-out leakage. Indeed, there are preliminary indications that the sandwich plates may meet regulatory body requirements for a double hull.

Finally, unlike a reinforced concrete ice wall, the composite option is totally insensitive to ice abrasion.

GENERAL DETAILS AND TESTING OF SANDWICH COMPOSITES:

Considering all of the advantages of composite sections, it is important to gain an understanding of the behaviour of this relatively new type of construction. In the numerous studies of composite design cited above, a large number of different configurations have been examined.

The dimensions and basic configurations of various selected test specimens are presented. In all cases, the overall dimensions and thickness of steel plate were chosen to represent, to a scale of one-third or one-quarter, the proposed ice-resistant wall of offshore structures that will be used in the arctic frontier. The properties of the concrete and steel selected were also typical of those likely to be employed in arctic construction. As well, a large number of different stiffener configurations were investigated. They were all conceived to provide passive confinement and adequate development of bond between the plate steel and the concrete. The following are representative examples of these stiffener variations.

Figure 6 shows a composite wall specimen designed by Hitachi of Japan during some of the pioneering work on composites in the late 1970s. A combination of diaphragm plates and L shape shear connectors were employed.

A different approach using Overlapping Welded Headed Studs was followed by Ben C. Gerwick in a joint industry project carried out in 1986-87 (Figure 7).

Finally, a simple but effective configuration using only continuous vertical diaphragm plates between the outer and inner steel plate was tested recently by C-FER (Figure 8).

In almost all cases, the test specimen failed by diagonal failure of the concrete core. Typically, a series of diagonal shear cracks formed in the concrete centred at the support, as the load was increased. At ultimate load, shear failure occurred in the cracked region at each end of the beam (Figure 9).

The load subsequently dropped by 15-20%, where it remained reasonably constant as the specimen was pushed through significant deformation. As deformation became large, the specimen began to take more load. At the conclusion of the test, the load was nearly back to what it had been at first failure.

A typical load deflection curve highlighting this double peak phenomenon and the significant post failure ductility available in the specimen after initial shear failure occur is shown in Figure 10.

Post failure ductility is important, since the area under the load deflection curve is representative of the energy that could be absorbed during an ice loading event.

APPLICATIONS:

One of the most prominent existing examples of sandwich composite construction offshore is the Single Steel Drilling Caisson (SSDC), shown in Figure 12. The SSDC was fabricated by modifying the forward body of a Very Large Crude Carrier (VLCC). These modifications included the construction of a sandwich composite peripheral wall for resisting ice loading. This peripheral wall utilized both an internal and external steel plate shell, a semi-light weight concrete infill, and shear transfer elements between the outer steel shell and the concrete.

Another existing class of sandwich composite structures is that found in marine projects such as underwater tunnels and tubes. Examples are the Bay Area Rapid Transit (BART) tube beneath San Francisco Bay and similar underwater tunnels in Hong Kong and Japan. Sandwich composite tubes were also used for construction in Denmark's Great Belt Link (Figure 13).

However, one of the most prominent potential applications of sandwich composite construction is for offshore platforms in the Beaufort Sea. Use of sandwich composite construction in the peripheral walls of such structure would allow concentrated ice loads, such as those that can dent all-steel structures, to be efficiently resisted.

Recognizing the great promise for such efficient structural systems in future offshore arctic applications, Gulf Canada has been actively involved in almost all of the significant research conducted to date. These study and research efforts have increased our understanding of composites and have provided us with a basis for the design of such systems.

Various in-house studies were recently performed by Gulf Canada to evaluate material types (reinforced concrete, all steel and composite) and construction methods for peripheral ice wall in Arctic Production Platforms, such as the proposed Amauligak CRI.

In order to compare the various material types, a number of preliminary designs were carried out. Five alternatives were selected for the comparison work, include two composite schemes (diaphragm plates and overlapping studs), a hybrid scheme (open-faced composite), a reinforced concrete scheme and an all-steel scheme.

Figures 15 and 16 show the two composite wall alternatives. These two schemes were developed from the research work of C-FER and Ben Gerwick respectively. The basic difference between the two schemes is the method used to fasten the exterior plates together; C-FER used transverse diaphragm plates and Ben Gerwick's used overlapping headed studs. Both of these systems work well and provide reasonable bulkhead spacing and plate thicknesses.

The "hybrid" scheme is shown on Figure 17; it is a combination of a reinforced concrete wall and a composite wall. This alternative came about by recognizing the possible need for a steel wear plate on the outside of a

reinforced concrete wall and by attempting to take advantage of the situation by using the plate structurally. The outside plate is connected to the wall using large diameter, friction-welded studs.

Results of these efforts indicate that all of the designs are technically feasible, although cost and other factors make some more attractive than others. Cost comparisons for the peripheral wall alternatives are illustrated in Figure 18. In reviewing the cost comparisons, the following points are apparent:

- The concrete, composite and hybrid schemes are all in the same general range
- The all-steel cost is much higher than all of the other schemes

The competitive cost of the composite alternative is consistent with preliminary expectations. It means that the beneficial attributes of the composite scheme (such as abrasion resistance and ductile response at ultimate) can be used to advantage, without incurring a cost penalty.

SUMMARY:

The significant research conducted to date confirms the promise of composite steel/concrete construction as a medium for resisting high local loading. Taking into account the many additional benefits in terms of durability, safety under overload, ease of construction, abrasion resistance and a double air, water and oil-tight membrane, composite construction offers enormous technical and economic potential. There is no doubt that a structural system that has as many advantages as the sandwich composite system will be used in the future for the construction of Arctic offshore platforms, and for a variety of other applications.

STUART AITKEN:

Thank you Charles. Our last speaker is Norman Miller, Executive Vice-President with LASMO Nova Scotia Limited. Norm is a native Nova Scotian, born and raised in Elmsdale. He is a graduate of Dalhousie and the Technical University of Nova Scotia.

His early years in the petroleum business were spent with Shell, as a petrophysical engineer in Alberta and in Shell's early offshore ventures on the West Coast and on the Scotian Shelf. Mr. Miller gained international offshore development experience during a two year assignment with Natomus in Indonesia in the mid-1970s. Following his return to Canada, he was employed by Petro Canada during its early growth period.

Since 1979 he has been in the petroleum consulting business as President of EPI Resources and N.W. Miller & Associates Limited, based in Calgary. During these years Mr. Miller has specialized in planning and evaluation of new petroleum developments nationally and internationally.

Mr. Miller recently joined Lasmo as Executive Vice-President of Lasmo Nova Scotia Limited and he is responsible for LASMO's operations in Nova Scotia. Please join me in welcoming Norm Miller.

NORM MILLER
Executive Vice President
Lasmo Nova Scotia Limited

PRODUCTION SYSTEMS FOR OFFSHORE NOVA SCOTIA

Thank you Mr. Chairman, ladies and gentlemen. I won't be too long as I have been asked to join a threesome for tennis at 5:00 o'clock. It's going to be tight. Anyway, Stuart said that I had only a few minutes per barrel of reserves.

I will first give you an overview of what Lasmo is doing in Nova Scotia, beginning with a few slides on the company. Certainly, as a newcomer to the Canadian frontier, Lasmo is not that well known in Canada.

MARKET CAPITALIZATION:

The company's capitalization is around $2.5 billion Canadian, with current production, or production at the end of 1989, of about 85 000 barrels of oil equivalent per day. Lasmo has no downstream marketing; it is a purely upstream company, and it is about 90 per cent oil-orientated. Lasmo operates in about 16 countries worldwide, with the main areas of operation in the North Sea.

Lasmo began its operations with a stake in an Indian development; from that base, the company spread into worldwide operations in the early 1980s. It bought into the Dome/Hudson's Bay International properties, and now operates the former Hudson's Bay properties in Indonesia, a substantial number of their operations in Columbia and Gabon and exploration in several other countries.

The company is just building up its production rate that was stable in the early part of the 1980s; now it is at 85 000 barrels per day. With committed developments, production is slated to be about 150 000 barrels a day by mid-decade. About 60 per cent of that production will continue to be from the North Sea. That projection, by the way, doesn't include Cohasset-Panuke, if we get approval to proceed with that.

Turning to our project, it is offshore Nova Scotia, about 250 km southeast of Halifax and about 41 km southwest of Sable Island. You are all familiar with many of the gas discoveries that have been made, particularly Venture, just east of the Sable Island. Our proposed project is located to the southwest, along the carbonate bank edge and along the rim of Sable sub-basin. Geologically, looking at a cross section of the project, you can see the green slivers in this area, which represent the condensate reserves in the Cohasset location, right over the underlying carbonate bank edge. It is located at a relatively shallow depth, of 6 000 to 7 300 feet below the sea floor, and at about half the depth of much of the geo-pressured gas that is found in the deeper part of the Sable sub basin.

Here is a schematic of the project, and I will describe the basic elements. Outlining Panuke here on the left [inaudible] two zones to be developed by three production wells, and one injection well will maintain the pressure with water injection in the reservoir. These wells will be housed in a wellhead jacket in 145 feet of water at Panuke. Produced condensate will flow across 8 km east to Cohasset, where the Panuke production will be co-mingled with production from Cohasset.

You can see that Cohasset is a stack reservoir with lower Logan Canyon Sands in upper Mississippian [inaudible] We have five producers sandwiched between two end water injectors, again to maintain pressure through the life of the field.

The combined production from the two fields will enter production facilities on the deck of a production jackup rig, standing in 125 feet of water at Cohasset alongside the wellhead jackup. The jackup rig, of course, has to be a world class, North Sea-capable, year round rig, and there are probably only 12 or 15 rigs with that capacity in the world. The production facilities on the deck will, of course, separate the water from the condensate, and the gas from condensate. The stabilized condensate will be pumped through another submarine line through a common mooring buoy, and into a storage tanker, which will come on location about in April each year.

We are planning on seasonal production, staying on location until late November of each year. We will use the favourable weather window on the Scotia Shelf and avoid producing through the rough weather between December and March. The storage tanker will offload to the shuttle tanker, which will take the product to market. In effect, this gives a total project that is very small and conventional and simple, operating in a nice free area and with a fairly limited capital cost.

RESERVES:

We forecast about 60 million barrels in place at Cohasset, and about 40 million barrels at Panuke, for 100 million barrels of condensate in place. And for recovery, full projections are in the order of about 35-36 million barrels. We propose to produce it at a design rate of 30 000 barrels per day in the up-season, so we will recover about six million barrels per year over a six year life; a pretty short life by offshore standards.

PRODUCTION:

You can see this is confidential so don't tell anybody about it; it is the profile of confidence level in reserves. You can see we have a high confidence level of achieving 20-25 million barrels of condensate from the two fields, and there is a small chance we will exceed 45 million barrels. We have designed for the medium expectation of approximately the mid-30s for the six million barrels over the six year life. Of course, because of the uncertainty in reserves and since you can run as many reservoir simulations of these things as you want, the results are only as good as the data that you put in. We will have to live with this uncertainty until we actually get into production and get our operating experience.

But we have designed the project to live with the worst scenario, if that happens, and hence the limited capital exposure that we propose on the front end of the venture. This is the production profile just showing a six year life at about six million barrels per year, mostly from Cohasset. In the early stages, it's flat because we are going to save some good zones for perforation and completion later on in order to level out the production over the six year period. We will also try to level out the water somewhat, so we are not handling all the water at the back end of the production period. This just shows the results of the water and the combined production of six million barrels per year, and then the water build up over the life of the project.

DEVELOPMENT:

In terms of the technology and the approach, we have proposed, of course, the combined concurrent development of the two fields [inaudible] what attracts Lasmo to this project is the ability to flow Panuke across to Cohasset. We couldn't do it in reverse; we couldn't locate the jackup at Panuke and have Cohasset production come over, because Cohasset will have a lot of water produced with it. It's really the co-flow of the two fields that makes the financial returns acceptable and will increase the economic recovery from the two fields as well. So it's more robust from a risk-reward prospective and there are substantially greater benefits, we think, for Nova Scotia.

As I mentioned earlier, we are going to minimize front-end capital because of the limited reserves; hence we'll be leasing major facilities such as the jackup rig and the storage and shuttle tankers. We will monitor and respond to the operating conditions, starting out with a reasonable production without having too many disconnection periods for the storage tanker. By learning from our experiences, we hope that we will be able to increase our operating season somewhat. We will be in a position, however, to maximize recovery from the two fields and even to add additional potential production, if we have any success in exploration wells that we plan [inaudible] in the next year. The leased equipment, if its no longer needed for further developments in the area, can be redeployed into the world market either for drilling purposes for the jackup rig or alternate service.

This shows wave conditions, and you can see the favourable wave conditions between April and November. Waves exceeding 24 feet (the approximate wave height forcing you to drop back off the buoy with the storage tanker) occurs particularly in January and March on this graph, and we would be facing about 50 per cent downtime with the 24 foot design wave condition. This shows the same thing in more detail, taking a particular year and showing frequency of storms through the January-March period and the relative calm through the spring, summer, and early fall. Of course we do see the occasional hurricane showing up, and there will certainly be times when we are going to be off the buoy, even in the favourable weather window.

In terms of schedule, we are in the middle of the government approval process, and we are in the middle of the process of communicating our plans to the public. Under the commissioner that Fred Weir mentioned, Commissioner

Ellis, we have been around to different communities in Nova Scotia. In fact, we actually began the public process back in September of last year, when we started meeting with the interested fishermen up and down the coast in Nova Scotia to convey as early as possible what we plan to do and to get feedback into our process. For our planning purposes we will have, of course, formal public hearings in June.

If we do get a green light to proceed with production, we will be in a position to order our jackups and the production facilities in late summer. We plan to begin development drilling in June 1991, drilling to Panuke first and then shifting over and drilling to Cohasset. We will stay on location for the production which,we hope, will be our first scheduled season in 1992.

You can see the green bars, the sequential production periods. We plan for six of those, and in the winter months, the jackup rig will be on location and will be available for downhole remedial workovers on Cohasset re-completions, getting ready, in a sense, to get a clean start on the next spring. It will also be an opportunity to drill an additional well or two at that location if we need to.

This is the Panuke F99, the last well drilled on the two fields. That's the Gorilla One, which unfortunately was lost in towing in the North Atlantic. This was producing from the F99 well through a floating hose to the Irving Nordic to the Petro-Can operating well and the product was taken off to market [inaudible] of course this is another situation where the rig has to be certified over a multi-year period. It was in 42 metres of water and had similar ocean conditions to those we are going to be facing at Cohasset, so this is a pretty good model for us. We will have Lloyd's of London as our certifying agent for all of our rig and structure related work.

CAPITAL:

About $160 million in 1989 dollars is required, and the most intensive year of spending will be 1991, if we are on schedule. We will maximize the amount of work we can do in Nova Scotia and Canada competitively. We see about 36 per cent of that occurring in Nova Scotia, 32 per cent in Canada and the rest abroad. We have a very high operating cost for this project relative to the reserves, and relative to [inaudible] who are projecting about 70 million dollars per year in 1989 dollars through the production life. This will be largely foreign in content.

There is no rig of this capacity available in Canada and tankers of the size we are talking about—the storage tanker will be in the range of 120 000 to 180 000 deadweight tons, and the shuttle tanker about half that size—can't be sourced in Canada. We will again maximize what we can, and, of course, the personnel will be mainly Canadian. This is just a projection of our jobs, direct and indirect. You can see the peak being about 800 in 1991, with the construction of the project, and the ongoing jobs in the 340-350 range through the production life of the field. About 200 of those will be direct, and they will be filled mostly by Nova Scotians.

ENVIRONMENTAL CONSIDERATIONS:

We believe that we have a low risk for blow-out, and we will be concentrating very hard to make sure that doesn't happen. We have a very light product condensate, and in this case there is low gas content—less than 100 cubic feet per barrel—which is an unusual situation for a condensate but helpful to us in terms of well control. We are also at a shallow depth and normal pressures. There are no abnormal pressure gradients here. We think we will be in a pretty good position for well control, but we will be downhole pumping most of those wells, probably with electric submersible pumps.

We are out of the range of major shipping lanes because we are in the shadow of Sable Island. Shipping really avoids that whole area. With tanker specifications, navigations control and training, which we will emphasize to a large degree in this project, we hope to minimize the chance of any kind of a tanker accident. If we do have a major accident in the Cohasset-Panuke area, we have done a lot of work concerning the impact this product would have on the environment. It is a very special product; it looks like Bacardi golden rum, but doesn't taste quite as good. It is a very light product, very low viscosity, and dissipates very rapidly in a marine environment—in fact, it evaporates very quickly. We have done major spill scenarios where we can't make a shoreline impact on Sable Island, which is 41 km away, In fact, we can't even get the product half way there before it's dissipated, primarily through evaporation.

There are some other safety considerations because of the volatility of the product. There will be implications for us in terms of whether or not we attempt to boom and gather this stuff, if we had a spill. In all likelihood, the wise thing to do is to let it evaporate, because it's not going to harm or adhere to anything anyway. That's a very important aspect of this particular product from a marine environment perspective.

We will have an exclusion zone immediately around the area that will, we hope, keep all marine traffic from traversing the immediate area of the two jackups, the storage tanker and the corridor where the pipeline goes between two fields. Here is an illustration of the frontier oils, mainly frontier oils in Canada, and the dispersibility comparisons. You can see the Panuke at about 54 per cent dispersibility in 5 minutes for this particular experiment; the next best oil was Atco at 20 per cent. We are almost three times more rapid in dispersibility then the next best crude in the frontier, then, so that is a very, very different product.

It is so important to co-exist effectively with the fishery so we don't compromise their future and opportunities in any way. We are fortunate that our location is in shallow water in the east end of the west Sable bank in the high surf area, and we have intense wave conditions through the winter period. There is not a lot of accumulation of nutrients and food for fishstock in the area; therefore, it is not really heavily fished. The fisherman generally acknowledge that it is not a high value fish area. There are no on-bottom fishstocks in the area. Probably the main consideration for the fishermen is our exclusion zone, which we will want them to avoid. It does cross the teleglobe cable, which is in

a exclusion zone anyway, just northeast of Panuke between the two fields. Therefore, our exclusion zone will be partially superimposed on an existing one. We do subscribe to a lot of the work that has been done between the fishermen and the CPA on compensation plans, and will be fully supporting that and even building on it, where we can make it more effective.

SUMMARY:

This is a small project by frontier offshore standards: a very simple, manageable project using conventional, 15 year old technology, with no prototypes, nothing to invent, shallow well depths and normally pressured reservoirs. We are in the ice-free area with no pack ice, and no icebergs. This will be an important project for Lasmo and, of course, for Canada. It is the first development offshore in the country so we want to do it right. We have an environmentally friendly product, and we don't mean that in a provocative sense. We mean that we have a sulphur-free condensate, the next best thing to natural gas. With every tanker load of condensate, we displace the need for something that may not be as environmentally attractive. We also think that it will be a premium product in the marketplace. In the 1990s we will see a good demand for condensate. In relative terms, we think it is a product and a project for the 1990s. We have a few brochures that you can pick up; they describe some of the basic elements mentioned in my speech.

Thank you.

SESSION VII DISCUSSION PERIOD

STUART AITKEN

Thank you Norm. We haven't quite recaptured the time that we lost in the earlier part of this afternoon. However, the panel would be happy to respond to any questions you may have, so don't let impatience for the barbecue overcome your thirst for knowledge.

TOURAJ NASSERI:

I have a question for Renger. Have you considered the impact of information on [inaudible]?

RENGER BIERMA:

No, not really, we are looking very much for automation in drilling facilities [inaudible] We certainly are looking at ways which we can further enhance the safety of our people offshore.

KEN CROASDALE:

A question for Norm. Norm, the Cohasset/Panuke platform is based on conventional jackup technology, but have you thought about exercising the new Canadian offshore standard in reviewing the design of this platform and facilities?

NORM MILLER:

Yes, we are paying close attention to those standards and for the jackup rig and the installation of the rig and the certification of it over a multi-year period and the jackups for the wellhead [inaudible] ?

QUESTION:

[inaudible]

NORM MILLER:

Well, we have done really two ways of marketing, one a study and next a team to think of some of the potential sites in North America, including eastern Canada and the eastern seaboard of the United States. We have received, we think, a strong interest in the product. It really depends on what it's going to be used for. It probably best serves a petrochemical market, as a petrochemical feedstock, but it could also be a good jet fuel source, good blending material. But we won't do an explicit marketing of the product until we have project approval.

QUESTION:

[inaudible]

NORM MILLER:

Both. I think we will not likely see that located southwest of the island, and what you might see off to the bank or around the gully area, you won't even see where we are at Cohasset-Panuke. We certainly don't expect anything that would materially affect the design requirements.

If we have no other questions, I have another message from Barry. It does not relate to buses. It just asks that you remember to take your liquor tickets with you. The alternative is money, because it is a cash bar. Would you please join me in thanking our panel for their presentations this afternoon and their response to the challenge of bringing it to market.

SESSION VIII

THE PUBLIC CONSULTATION PROCESS

INTRODUCTION:

IAN SMYTH
President, Canadian Petroleum Association

Thank you Barry. I intend to have us free and clear of this room by 11:30. After our three panelists have made their presentations, we will stop for questions. We will then move to coffee, and after that, to the next three panelists and repeat the process. I will have a few remarks to make at the end.

By way of introduction to this morning's subject, let me tell you about a friend of mine who was in Toronto lately. He had recently retired from his company. He had a wonderful gold watch, which had been presented to him, and he dropped it and it stopped running. He was quite distraught because it was a very valuable memento of great personal and emotional significance. So he went in pursuit of a good watch repair shop. He made his way up Yonge Street, and ultimately he came to a store front that was beautifully decorated in purple velvet and nice walnut panelling. And there in the window stood a grandfather clock: a beautiful case clock, clearly many years old and in absolutely perfect condition—ticking. He thought this must be a quality place to handle his watch, so in the door he went. As soon as he got inside, he saw a repetition of this beautiful motif of velvet and rich wood panelling. Through the curtains at the back of the room, there materialized a man in a morning coat, striped pants and a wing collar. He approached my friend very courteously and bowed and said, "Can I assist you, sir?" "Yes," my friend said. He produced the watch and said, "I would like you to fix this." The man looked at the watch and said, "I am sorry, sir, but we don't fix watches here." "Well," my friend said, "I saw the clock in the window and I thought..." "No," he said, "I'm sorry, but we don't fix watches." My friend said, "What do you do?" "Well, sir, we spay the finest cats and dogs in Rosedale at this establishment." My friend said, "You spay cats and dogs?" "Yes," the man said. My friend said, "My God, why do you have that clock in the window?" And the man said, "Sir, if you were in our business, what would you put in the window?"

Public consultation is the process through which we put things in the window, and it is practised with varying degrees of sophistication and acuity by resource-based industries and companies. It is obviously most prominent in the planning stages for our major new projects, but it is becoming more common as an element of our day-to-day operations. Regulatory bodies always encourage, and sometimes insist, that companies consult with those who may be affected by their projects and operations. For most of us at the Canadian Petroleum

Association, consultation has been a way of life for many years. We have asked representatives of three regulatory bodies—Norm Strom of the ERCB, Peter Carr of National Energy Board and Paul Scott of FEARO—to comment on their public consultation requirements. It will be interesting to hear from them, and perhaps through the question period, we will hear about their own consultation duties and what they require of us. Following the coffee break, we will hear from two consultees and one consultor on how the process serves their needs and fulfils their expectations. Those people will be Jim Livingstone of the Federal Inuvialuit Environmental Impact Review Board, Earl Johnson of the Come-By-Chance Area Fishermen's Committee and Tom Thompson of BC Hydro.

Clearly, co-operation and understanding among stakeholders in any development process are crucial to the long-term success and the easy progress of the regulatory process. It will be interesting to learn from our panelists if they think public consultation, as it is currently practised, is achieving the goal of co-operation and understanding.

We will start with Norm Strom, who was born, raised and spent his early years near Viking, Alberta. He attended the University of British Columbia, graduating in 1954 in geological engineering. In 1956 he joined the ERCB, and from 1961 to 1974, a very interesting period for the oil sands business in Alberta, he headed the ERCB's oil sands department. He took a two year sabbatical in Kuwait, came back to the ERCB, and he has worked on virtually everything that you can imagine—all the way from long-range oil and gas projection to sour gas well blow-outs and a whole lot of stuff in between. He has been a member of the ERCB for the last nine years, and is currently its Vice-Chairman. Norm, over to you.

N.A. STROM
Vice Chairman
Energy Resources Conservation Board

PUBLIC CONSULTATION—THE ERCB EXPERIENCE

Thank you Ian. For one thing, I am really surprised to see everybody here—the weather must be really bad out there. On the last morning, I thought everyone would be thinking about packing up their goods and being out golfing.

After hearing the presentations over the past couple of days, I realize that dealing with individual little wells out in Alberta was not exactly the central focus of the group. We were dealing with very specialized questions, and some have taken on the manner of some of the mega-projects, like the oil sands. As a result, rather than going through my fixed speech I did a bit of rewriting.

The title of my presentation is the "Public Consultation Process—The ERCB Experience." As many, if not most of you will know, the ERCB has been in operation for some 52 years, and has a staff of about 700 people. It deals with between 10 000 and 15 000 applications per year. We regulate the scope of all of the energy industries, not just petroleum—coal, hydro, oil, gas and oil

sands—and we deal with the permitting and licensing of mines, wells, pipelines, transmission lines, petro-chemical plants, oil sands projects, batteries, you name them. Directly and indirectly, the energy industry in Alberta employs approximately 250 000 people. As a result, the activities that we regulate and the manner in which we interact with industry, and the industry interacts with the public, ourselves and the government, has a great impact on the fortunes of the province of Alberta.

As you also probably know, I think the energy industry represents something like 40 per cent of the gross domestic product of the province. So, to some extent, the ERCB gets into the public focus, in addition to the good people at CPA and all of the energy industries.

Forty years ago, the ERCB was primarily embroiled in devising policies and drafting legislation and guidelines aimed at steering the industry and the province towards long-range benefits from the very significant oil and gas discoveries that had been made. ERCB handled such things as: the gas removals policy that provided for thirty years' supply; the direction toward development of the petrochemical industry; and the matter of maximum upgrading and utilization. Twenty five years ago, when I was in the thick of a lot of technical work, we were submerged in a great host of energy developments—probably a majority of significant oil and gas discoveries in terms of volume were being made at that time. It is a paradox that, with 75 drilling rigs, we probably found about three-quarters of the oil and gas reserves that we have now, which we are chasing with about 500 drilling rigs. But, hopefully we are still not at the point of diminishing returns.

At that time, also, it was not uncommon for us to engage in bare knuckle exchanges with the energy industries. Our counterparts were all technical people. We were highly technically oriented. We had one lawyer and did not spend much time on legal matters. But I can tell you that we got down to the bare facts very fast, and sometimes it was an outright fight. It was all to the good, I think. We have all come out laughing at it afterwards. There were gainers all the way around, and I think we set some rules and procedures and precedents in practices like production measurement, information gathering, procedure for obtaining reservoir fluids, sound water disposal and drilling practices. So, there was a lot of consultation and exchange between us, but it was pretty much limited to that. Indeed, the provincial government literally did not interact—we had almost negligible interaction, except with the Department of Health on such matters as well casing to prevent contamination of groundwater.

The last fifteen years, though, have seen a very significant metamorphosis. We have gone from what was industry/ERCB dialogue to a situation where it is industry—the public—and ERCB/the government, if you like. We act a lot with Alberta Environment and with another significant environmental department—Forestry, Lands and Wildlife. The whole process has tremendously changed, and it has been quite an upheaval for all of us to cope with.

In the middle 1970s, we had several major projects. Power plants, electric transmissions corridors, petrochemical plants, the Cold Lake Oil Sands project all came forward. At this point, the environmental movement was in its "walking stages", and the public was becoming concerned about the environment and demanding participation in the process. This was occurring on a scale that we had never seen before in the province. The ERCB, to be honest with you, found itself floundering in the process. You must bear in mind that we were still dealing with thousands of applications, and if we were caught up in litigious hearing processes there would have been no end of it. I don't know what would have happened with the size of our staff. We had to cope with several thousand applications. So, it caused us to try to find out what we could do to alter our process, to ensure that it, at least, would be streamlined and still allow a legitimate opportunity for the public to participate. We enlisted the co-operation of industry and other government departments in looking at this. We tried to get out of the state of siege.

Initially, we saw a need to assist intervenors so they could make their own sound, independent assessments of projects on an efficient basis, and participate fully in the application process. The process for intervenor costs, for directly and adversely affected parties, was begun. For the first time on a large scale, participation in hearings involved representation by legal counsel as well as the assistance of engineers, geologists, biologists, etc., to address specific issues. Participation boomed, especially for the lawyers; but not all was peace on the western front, and the costs really went up. We had some marathon hearings. Can you imagine sitting for 30 and 40 and 60 days at a time with legal arguments? For an engineer cum adjudicator, I can tell you that it really tested us. It was very adversarial. Often what happened in this process, with lawyers trained to defend their case to the very end and people not properly informed, was that all parties—industry, the ERCB, public participants—were looking at the world from their own angles and not always with understanding of other positions. In the end, with the ERCB process, and this must really sound bad to all you people, we literally have never turned down an application for a well licence. Literally, I say, because we have licenced 120 000 wells in the province, and I guess we have turned down a half-dozen, but not too often. We have turned down a few enhanced recovery schemes, but they came back in some other form. Usually we look for the right solution, rather than saying you can't do this. Therefore, in the public's eyes, it is a totally one-sided process with the perception of win-lose.

This atmosphere of development led us, however, to conclude that we certainly did not have the solution. We looked at the matters of information exchange, issue identification, impact and risk communication, and conflict resolution. We had people from across the continent talk to us privately on risk communication in the nuclear industry, for instance, and on how we could improve our process of communication. We also looked at the culture and language of the participants. Working in this job it would really help if you were a sociologist rather than an engineer, because the language of communication and the culture from which people come have a very pervasive effect on the way we see the world.

Indus.ry people, as you have heard in the last couple of days, talk about technology and economics. They deal in the physical sciences and mathematics, and they are practised in a very careful process of evaluation and forecasting in which the outcomes are, very frequently, highly predictable. The public, for its part, is concerned with health, safety, family and lifestyle. The public also makes its decisions on the basis of perceptions—about what the world appears to be and gut feelings. Now, engineers are experienced in gut feelings too. They don't lack these, but they have enhanced them a great deal by adding the sophisticated knowledge of the physical and mathematical sciences. These two approaches, when brought to the table, frequently cause parties not to talk to one another. They are on different planes; they go past one another in the night. The third party to this, the government, inclines to considerable empathy for the industry approach to things, or at least the discipline the industry brings to problems, and to an empathy for the public trying to cope with and see where it fits into this. We had a communications problem, and at the ERCB, over the past fifteen years, we did not come up with instant solutions. I have often said that we have bumbled our way through as we went along.

I want to mention three examples of where we have gone over this period of time. They are: how we would handle a coal project; how we would handle a sour gas plant; and how we might handle an individual well licence.

THE COAL PROCESS—THE MERITS OF AN ORDERLY PROCESS:

In the early 1970s a major mine-mouth power development was proposed to be installed near Camrose in central Alberta. The developer proceeded with full-scale engineering and development plans. When this farming community became aware of the land disturbances that would occur, a storm of opposition to the project sprang up. Eventually, the government was forced to backtrack totally on what it had originally thought was a sound proposal.

This case led the government to initiate a review of its entire procedure for handling proposed major coal projects. The result was development of a four stage procedure:

i. Stage one involves preliminary intra-governmental screening ("Preliminary Disclosure") of proposed coal projects to establish whether they would be acceptable in relation to broad guidelines regarding land use, social impacts and government economic development philosophies. For this purpose, the proponent provides a concept development proposal—which is confidential—with sufficient information to allow the broad policy tests to be made. If the proposal fails, it is simply refused and no public accountability is involved. If the proposal meets the tests, the proponent may then proceed to the "Public Disclosure" stage.

ii. The second stage requires that the proponent launch a thorough public consultation process. The project proposal is fleshed out in reasonable detail and presented in plain language. A "Public Disclosure" document outlines all aspects of the proposal includ-

ing technical data, environmental impact and mitigation, social impact and cost/benefit aspects. During this stage, public input on the merits and problems with the proposal are evaluated, and measures are developed to address any major public concerns. As the public consultation proceeds, the proponent moves ahead with firm project plans including engineering, environmental and community infrastructure considerations.

iii. The third stage involves filing a complete, detailed application to the ERCB for the coal mine (or a coal mine plus electric power facility where an integrated development of that kind is involved), with full documentation to address technical, safety and resources conservation issues, environmental impact plus mitigation and protection, and social, community infrastructure and economic cost-benefit matters. This application comes before the ERCB for a public hearing to consider any public concerns that are not resolved, to reach a decision on the application and to prescribe any special conditions that would be met before and during the construction and operation of the project.

Subject to Cabinet adoption, ERCB mine permits and power plant approvals are the legal instruments under which such projects may proceed.

iv. The fourth stage involves detailed licensing and regulatory follow-up and enforcement of operating conditions. For coal mine developments, companion regulations to ensure sound environmental management are administered by Alberta Environment under their Clean Air, Clean Water and Land Conservation and Reclamation Acts. In practice, the ERCB and Alberta Environment closely co-ordinate their regulatory functions.

The Coal Application Procedure is well established and generally well understood by stakeholders. The public understands they will have an opportunity to be fully informed and to participate in solving specific problems, if an application passes the Preliminary Disclosure policy clearing stage, but prior to a formal ERCB application being submitted. As a result, the acrimony, distrust and dissatisfaction that beset the ill-fated Camrose proposal has not been repeated in any coal development processed by the ERCB since that time. That is not to say that everyone greets those developments with open arms, but everyone knows what the rules of the game are.

Conventional Oil & Gas—Learning by Painful Experience: The story of public participation in conventional oil and gas developments, however, has not been nearly as orderly or unruffled. Indeed, public consultation concerning such developments has taken an uncertain course, and not only the public, but industry itself, has often been rather confused as to where and how public participation should occur. One reason for the confusion is that conventional oil and gas well drilling proceeds on a piece-meal basis, with leaseholders competing to access oil and gas on adjoining lands. This process of competitive development causes companies with widely different corporate personalities, and drilling companies with varying safety records, to meet at hearings with

individual landowners or occupants, each with their own special attitudes and concerns. Larger projects like sour gas plants and central process facilities are "one-time" rather than "piece-meal", but can still lead to complexities in communication. Similarly, public consultation on large pipelines and power transmission lines can be complicated due to either the large numbers of individual landowners, or, as in the case of bitumen mining synthetic crude oil upgraders, large populations of stakeholders with reason to be involved.

Ever since the call came from UNIFARM in the late 1970s to move well sites to the corners of cultivated fields, instead of placing them in the centre, and to provide for reasonable planning to avoid unnecessary land disturbance and oilfield pollution, the ERCB has been caught trying to improvise ways of resolving landowner problems.

In the late 1970s and early 1980s, the need to provide understandable information, in the right forum and for site-specific conditions, became even more obvious when a host of environmental concerns were thrust up at ERCB public hearings. "Silent Spring" was followed by "Still Waters" and we heard of a growing number of concerns about soil acidification, heavy metals, selenium deficiency causing white muscle disease, damage to crops and stress on forests from sulphurous acid-forming emissions, threats to health from low-level sustained hydrogen sulphide emissions, loss of agricultural lands, inappropriate soil stripping and reclamation procedures, causes and risks from fugitive odours, noise pollution from large staccato-like engines, pollution of lakes and groundwaters and general sullying of our environment. Initially, we endeavoured to address each problem on a scientific approach, engaging the advice of people like Bill McGill (soil science), Ron Wallace (aquatics science), or L. Lillie (animal science), our belief being that the problems were specifically physical, chemical or biological in nature.

But it became clear that the problem was not just one of assembling reliable scientific knowledge and requiring better industry studies and monitoring of field sites. Inevitably, the need was seen to be one of providing information to and communicating with the public in plain layman's terms, of sitting down and joining the individual householder in a direct consultative activity. Communication, information-exchange and consultation became the by-words. What has now evolved is a set of public consultation guidelines that outline how industry, government and the public should jointly participate in solving energy development impacts.

THE CONTEMPORARY ERA IN ENERGY INDUSTRY PUBLIC CONSULTATION:

By example, let us consider the recommended step-like procedure that would be used when proposing a sour gas plant. For this, there are six distinct stages:

i. Project concept to conform with provincial and municipal land use designations. (This, in part, is equivalent to the much wider ranging inter-governmental, preliminary screening, "Preliminary

Disclosure", now used for coal projects and bitumen/synthetic crude projects like OSLO.)

ii Project concept to be disclosed to local communities to launch assessment of concerns and issues. (This is the equivalent of the "Public Disclosure" stage required for coal and oil sands projects.)

iii. The public consultation proper. Extensive information exchange and one-on-one problem-solving occurs in the community. At the same time, drafting of the ERCB and Alberta Environment applications is launched. Local involvement may be extensive. Provisions have been established under ERCB legislation for the project sponsor to provide funding to local interveners to retain expert legal and technical expertise to deal with the application.

iv. In the fourth stage, the formal application set (technical, environmental, socio-economic and cost/benefit) is filed with ERCB. The application, when fully complete, is brought to a public hearing following which the ERCB rules on acceptability and conditions. During this stage, unresolved points of conflict will ordinarily surface, and the burden is shifted to the ERCB to hear and rule on the questions at issue. If stage 3 has been thorough, the parties appearing know clearly why they are at the hearing and what their weapons and strategy will be to get the attention of the ERCB adjudicators. The hearing stage is to allow the proponent and any opponents full and fair opportunity to be heard, following which the quasi-judicial renders a ruling, often attaching conditions to mitigate concerns raised by interveners.

v. The fifth stage is post-ERCB decision, and involves implementation of ERCB and Alberta Environment approval and licensing conditions, including confirmation of decision results to local residents and scrutiny of activities during construction and start-up.

vi. The remaining life-long stage involves continuing surveillance of production operations, including immediate follow-up of operational upsets, accidents or citizen complaints. Industries that work to be a partner in the community, sharing the concerns of the community enjoy the benefits of public acceptance and support.

The Board's experience is that public concerns most frequently relate to:

- Public health and safety
- Impacts on property values
- Impacts on personal land use
- Concern about pollution of air, surface water and groundwater
- Intrusion or irreversible damage to ecological communities and habitat

Where thorough and honest communication of these concerns occurs during the public consultation process, objective problem-solving takes hold. Not infrequently, local residents provide innovative advice on how to design a project to achieve the lowest practical impact or risks.

Alternatively, where misinformation is introduced either by an applicant, or someone else, the process can become tainted, and mistrust ensues. Utmost care must be exercised to guard against this, because removal of misconceptions and misunderstandings can be extremely difficult. A communication hysteresis loop can ensue, often preventing the parties to get back to a proper starting point for joint problem-solving. As well, the actions of one bad actor often lead to problems for other careful, thoughtful members of an industry.

Fortunately, the energy industries and their cousin chemical industries have launched wide-ranging programs of public consultation in recent years. These have been translated into formalized mission statements and guidelines so that the chances of misunderstanding or oversight are greatly reduced. As a result, the ERCB is now but one party in the process of information dissemination, issue identification and conflict resolution that involves the concerned publics, the project proponent and other government bodies, local as well as provincial.

In summary, a sound public consultation process must:

- Be honest and open.
- Be launched at the appropriate time, after—not before—general government policy endorsement, but well before formal application.
- Set out to achieve participation from all of the publics, be those local, regional, or special interest.
- Search for common levels of knowledge and understanding. A problem cannot begin to be solved until it has been defined.
- Search for win-win solutions. Often the neighbour of an energy industry receives the impacts with no perceivable benefits. With some imagination, off-setting benefits may be devised. Short range displacement of site-specific ecological communities may be offset by substitute ecological enhancement programs elsewhere. Try to be innovative and a bit adventuresome. It may pay.
- Be endowed with patience to build trust and reach common points of view that make for proactive problem resolution.
- Follow an orderly process. Premature announcement of a project by a sponsor or pre-emptive announcement of approval by a government without going through the reliable four-stage Preliminary Screening, Public Disclosure to Public Application and Hearing stages can lead to a sense of apprehension and deep distrust by the public. Don't short-circuit the process, regardless of temptation. Short-term gain may mean long-term pain.

IAN SMYTH:

Thanks Norm, you underlined a point that we make around the CPA that our worst nightmare is that we should come to be regulated at the level of the worst offender. This is why we have put an awful lot of effort in the development of the consultation processes. One of the most heart-warming experiences I can have is the sporadic quotation, and I see them in the newspapers, from environmentalists who stand up at public hearings, brandishing the CPA's consultation manual at other industries and saying, "Why can't you guys do it like the CPA?"

So, we are rather proud about what we have done in that area, and it is partly as a result of the fact that DAD (decide, announce and defend) is dead and no longer a viable strategy, but also because of the goading and perseverance of the ERCB and, as well, of the National Energy Board, which has also mandated public consultation for our industry.

Here to talk about public consultation is Peter Carr, who is the Director of the Environment Branch of the NEB. Mr. Carr has a BA in geological sciences from the University of Toronto, and a PhD from the University of Illinois in hydro-geology. Peter knows something about our business. He spent most of his career with the government of Canada, first with Geological Survey, then with the Department of Environment, and finally, at the National Energy Board. He has also had some time overseas, either with the United Nations or with CIDA, in places like India and Fiji. You always seem to get the warm ones, Peter. Nice life. On that note, Peter Carr.

PETER CARR
Director, Environment Branch
National Energy Board

THE NEW PUBLIC NOTIFICATION REQUIREMENTS FOR PROPOSALS BEFORE THE NATIONAL ENERGY BOARD

Thank you Mr. Chairman. Good morning ladies and gentlemen.

Today, I wish to talk about "The New Public Notification Requirements" for proposals submitted to the National Energy Board. For the most part, I will focus on pipeline projects, but from time to time I will refer to other types of proposals that come in front of the Board.

First, let me provide you with a brief overview: I wish to review the existing notification requirements; then to discuss the reasons why new initiatives have been generated at the Board; and finally, I will discuss the content of the new initiatives.

PART 1: EXISTING REQUIREMENTS

The existing notification requirements are contained in a two page document, called Part IX of the Rules of Practice and Procedure. This requires that for any pipeline project that needs new land, the proponent must file the names of the authorities and organizations contacted when determining the feasibility of the rate. This filing should also include any constraints or approvals noted by the various authorities (i.e., federal, provincial or municipal). The requirement was designed to provide the Board with a measure of the public concern relating to the application, and a measure of the viability of the proposed route that was being considered.

PART 2: THE REASONS FOR NEW PUBLIC INFORMATION INITIATIVES AT THE NEB

Over the last few years, several problems arose over some applications considered by the Board. It became apparent that certain intervenors were voicing their concerns at the end of the hearing process, or even after the hearing had finished. It had become obvious to the Board that the process was not adequate in all cases to provide sufficient time for the public to respond to these applications.

In addition, there was criticism about the lack of notification and opportunity for public input during the planning stages of certain projects that were considered by the Board. This, according to the public, allowed the Board's review to progress without its knowing the full extent of the public's concern. Let me say here and now I am talking about the exceptions, for indeed many companies were doing an excellent job in their public awareness programs. However, there was some slippage.

Around the same time—this was in the early fall of last year—the federal court decisions regarding the Rafferty/Alameda project were released, and they set the stage for future public environmental reviews in Canada. The decisions determined the Environmental Assessment and Review Process (EARP) Guidelines Order to be law of general application that must be implemented by federal departments and agencies in a "legally defensible, practical way". The decisions by Justices Cullen and Muldoon stated, basically, that the EARP Guidelines Order should have been initiated to examine the potential environmental effects of the Rafferty/Alameda project. The EARP Guidelines Order also requires that initiating departments, such as the NEB, consider the concerns of the public when reviewing a proposal

Thus, it became apparent that the Board's process should be made more vigorous by implementing stronger requirements as part of a public notification program.

In examining the options, the Board noted that the Energy Resources Conservation Board in Alberta had legislation encouraging the companies to initiate a public consultation program that was judged to be very effective and had been in place for several years.

In the fall of 1989, the Canadian Petroleum Association also adopted and released their own "Public Consultation Guidelines". So clearly, here was an idea whose time had arrived.

After analyzing the matter, two initiatives were generated by the Board. They included:

i. a draft Memorandum of Guidance encouraging early public notification

ii. an effort to get the proponents to improve published notices in appropriate newspapers indicating to the public the details of any energy project proposals that may affect them

The draft Memorandum of Guidance was sent out for comment in early September 1989, and the revised version is to be released in May or June 1990. The improved newspaper notice is not official Board policy as yet, but the Board indicated that the changes would be in keeping with the spirit of the draft Memorandum of Guidance.

The objectives of the initiatives are to emphasize the co-operative consultation between the public and the proponent, thus the issues that are deemed by the public to be important are identified at an early stage; this, in turn, ensures that the public concerns are made known to the Board prior to the hearing.

PART 3: THE NEW BOARD INITIATIVES MEMORANDUM OF GUIDANCE

The draft Memorandum of Guidance regarding public notification requirements was released to the public for comment after extensive review within the NEB. The draft document was sent to all companies under the Board's jurisdiction, and to public interest groups and government agencies. Parties were given six weeks to provide their comments on the document to the Board.

The comments that were received were quite wide-ranging and the perception of what the public notification requirements should be varied from one end of the spectrum to the other. There were a few interested parties that argued that additional notification guidelines were not required and that, if any were adopted, it would create an unnecessary burden on the proponents. At the other extreme were parties that argued that the guidelines further empowered applicants before the Board to do as they wish, when they wish, without giving the Canadian public any real voice in Board decisions.

I must emphasize, however, that those opinions were, by far, the extreme. The general consensus of those who responded was overwhelmingly in the centre. This included nearly all the pipeline companies and electrical utilities regulated by the Board. The comments received from them were generally very positive, and most suggested minor changes in the scope and wording of the document. Many of the comments included suggestions to make the requirements more practical and effective, and these suggestions should ultimately provide for a much improved guideline.

PART 4: THE CONTENTS

This is a draft version for companies to implement a public information program if they plan to build or expand their pipelines, export electricity, or export high-sulphur crude oil from the West Coast. Depending on the expected impact of the project, the public information program could vary from newspaper notices to a series of public meetings in affected communities.

The information required is quite basic and is required only for proposals that are determined as having significant environmental or social effects.

The Memorandum of Guidance sets out the following directions to be implemented.

1) Prior to the filing of an application, the proponent is required to implement a public information program to:
   i. explain the proposal
   ii. discuss its potential environment and social effects
   iii .allow the public an opportunity to comment

The type of program to be provided will vary with the proposal, but it should include a map available in a convenient location for public viewing, so that individuals can determine whether they will be affected directly by the proposal.

It is important that interested parties be provided adequate time to comment on the proposal and that the applicant is responsive to any relevant questions put to them by the public.

2) When the application is filed with the Board, the proponent must provide:
   i. a description of the public information programs
   ii. he type of notification used and the date
   iii.the date and location of meetings held
   iv. a summary of the public concerns and comments expressed in respect of the potential environmental and social effects of the proposal

3) If the applicant determines that the environmental and social effects are insignificant, then the applicant may request exemption from the requirements of Section (1) and (2).

4) Certain proposals are exempt from the public notification requirements. The Board determined, after consulting with interested parties, that certain types of work, acquisitions and maintenance do not have the potential to create any significant environmental or social effects, and thus would not require early notification program.

As can be seen in Section 4(A), work at compressor or pump stations is exempted from the requirement if there is no need for storage or disposal of toxic substances, no increased noise emissions and no increased emissions of air containments.

This part should conform with those projects that are automatically excluded from environmental screening. It is reasonable to assume, then, that this part may change or be modified depending on the negotiation of exclusion lists and class exemptions with FEARO.

I hope that the revised draft Memorandum will remain as such for at least the next few years. During that time the guidelines will be tested and rewritten, if required, to get the "bugs" out.

5) Public Notices When an application is submitted to the Board and a hearing date is established, companies are required to publish notices in the local and regional newspapers. These notices should provide general information on the proposals and the hearing.

Normally this works well and the companies do a good job. Occasionally, however, a notice did not contain a map showing the route, but provided only a vague description of the location of the proposed route. Furthermore, some notices have been written in an obscure manner and were incomprehensible to the public. Needless to say, both these situations created a lot of mail to the Board complaining about the lack of clarity. The worst confusion occurred when one company had two projects in the same area at the same time, and both these types of problems were present.

As a result, the Board directed the proponent to publish new notices in a clearer manner. The proponent was required to: provide maps of a sufficient scale, so that the public could determine whether or not they would be affected by the project, hence whether they wished to intervene at the hearing; and to provide a convenient location where the detailed route plans could be examined at leisure.

At this time, the route is often better defined than the more general route that would have been identified in the early public awareness program. This new route may even have been modified as a result of discussions with the public.

The Board has not formally modified its publishing requirements for "Notices of Public Hearing" in its Direction on Procedures—for this problem is not a common one.

CONCLUSION

It is hoped that these initiatives of early notification and consultation with the public will help to identify and resolve many of the environmental problems or issues that the public may have.

They also should help to fulfil the Board's requirements under the EARP Guidelines Order to identify public concern, and they should help in making a more efficient Board hearing process in the future.

For the pipeline company, this effort is the start of an on-going program of public awareness with the affected landowners. This program activity progresses through the hearing and the construction stage of the pipeline. It continues through the operation stage, when maintenance must be carried out on the line, and when the line must be continually protected from third party construction activity, up to the point, many years later, when the company may wish to return to obtain additional right-of-way to loop the existing line.

IAN SMYTH:

Thank you Peter. We will hear now from Paul Scott, who is Deputy Director of the Pacific, Western and Northern Region of the Federal Environmental Assessment Review Office (FEARO). Paul is a BC native, and graduated from UBC in 1965 as a civil engineer. He joined Environment Canada in 1972, and moved to FEARO in 1979.

He has been involved directly or indirectly in environmental and environmental assessment matters for over 20 years. He is currently Deputy Director, as I have told you, and I am looking forward to hearing Paul's views on the public consultation process and, possibly, the industry consultation process as well. Thank you Paul.

PAUL SCOTT
Deputy Director
Pacific, Western and Northern Region

FEDERAL ENVIRONMENTAL ASSESSMENT REVIEW OFFICE

Thank you, Ian, and good morning ladies and gentlemen. First of all, I would like to present apologies on behalf of Ray Robinson. I am sure he would much rather be here than where he is, in Ottawa, involved with Cabinet committees examining and discussing proposed reforms and changes to the EARP process.

I would like to divide my presentation this morning into two parts. First, I will talk about the EARP process and public consultation in general, and then I will talk a little about the plans for changes to the process, specifically the proposed new Canadian Environmental Assessment Act.

In the last year or so EARP and FEARO have come from relative obscurity to being well known to the petroleum industry. Outside government and industry, however, we have not been that well known, and EARP has been a relatively obscure process. That has changed. The federal court decisions on Rafferty/Alameda and Oldman River have certainly propelled us into the limelight. Whether we want to be there or not right now is not too

clear to us right now. It certainly created a lot of stress and problems for us, and for others as well.

One thing it has done. Mr. Webster will have to change his dictionary because a new word, "EARP" has come into being. A while ago we looked on it as a noun, "the EARP", but now it's a verb, "Oh my god, I've been EARP'd". More and more developers are learning what EARP is all about, and it is not just the oil and gas industry now, it is the industries such as pulp and paper and mining that are being subjected more and more to the requirements of EARP. So, like it or not, we are now in the limelight, and I am not sure if we are the villains or the heroes of the piece. We like to think of ourselves as heroes by anyone involved in environmental assessment and public consultation, but you can be looked upon as heroes and villains at certain times.

One of the key principles of the EARP process when it was first introduced back in 1973-74 has been, and continues to be, the importance and emphasis on public participation and involvement. To some extent, the difficulties we are having with the federal court decisions have resulted from our past success in providing a forum for full public involvement and participation in government decision-making. Our success has led to many public groups demanding an increasing and widening scope of application of the EARP process, and this has been particularly evident in BC and Alberta. There is the perception, and probably the reality in the past, that the provincial environmental assessment procedures have not provided an adequate or proper forum for full public involvement in public consultation. As a result, EARP has been seen as the knight in shining armour and the EARP process as providing for meaningful public consultation. Therefore, there have been more and more demands for the application of the EARP in situations where,historically, the provinces had the main decision-making role and the main role in terms of environmental assessment.

To some extent, our success has been our undoing of late. Ironically, however, although EARP has been successful in terms of public involvement for environmental assessment panels, our record for successful public involvement in what will be called the initial assessment stage—the non-panel stage—has been less than impressive. In fact, one of the main reasons for the demands for reforms to the EARP process has been our failure to provide consistent and meaningful public involvement in what we call the initial assessment stage of the process.

The Environmental Assessment Panels. This is the phase which has attracted the most attention. It is the most publicly visible stage, where independent panels are established by the Minister and there are formal opportunities for public involvement.

Somewhat like an iceberg, though, 95 to 99 per cent of the process at the initial assessment phase is largely hidden from public view. At this stage, the responsibility rests with the department with the decision-making responsibility for a particular project. The public participation and involvement, at this stage, has been inconsistent and, in many cases, non-existent. I am not

suggesting that there has to be public involvement for all projects subject to EARP, but in the past, there has been a very inconsistent application of the principles of public involvement at that so-called initial assessment stage.

Here are two slides. They are actually from a training manual on the EARP process, and they outline some of the basics of public involvement from an EARP perspective. The five reasons for consulting the public were developed for government departments, but they apply equally well, I would suggest, to privately initiated proponents as well. I keep telling new industries that are now getting involved in EARP that, if they want to avoid court challenges, one of the best things they can do is effectively follow the example of the petroleum industry. They need to engage in early and meaningful and effective public consultation, and not wait until after they have made a decision on the project to do so. Here are some of the reasons why it is useful, and you already know this as well as anybody. They are in the context of the EARP process, and I am sure the techniques are ones that are familiar to you as well.

One of the criteria for deciding whether or not there is a need for a formal panel review is the extent of public concern. And one of the most effective ways to determine the extent of concern is to go out and consult with the public to find out what the its concern is. Lack of consultation can aggravate public concern and may generate public opposition that does not warrant a panel review. We have some of these situations right now, where we are involved in panels primarily because proponents did not carry out effective public consultation programs. As a result, we have situations where the public concerns may not be warranted but are, nevertheless, very real.

To provide assistance to all people involved in EARP, FEARO has commissioned a manual called "The Manual on Planning and Implementing Public Involvement Programs", which was produced by Practice Consultants of Calgary. I am embarrassed to admit that, even though the manual has been out for about year now, the government requires it to be translated into French, before it can be distributed widely. That has finally been accomplished, and it will be available for distribution in the next few weeks. If you want a copy of a general manual on public involvement and participation, then, we will be able to provide it shortly.

Last year, on April 10, 1989, things changed for us. That was the day the federal court decision came down on the Rafferty/Alameda Dam, and it changed the way we do environmental assessment—the way we do our business. As a result of the Rafferty/Alameda decisions and the Oldman River decisions, two things happened. First, the scope of the EARP process has broadened to the extent that virtually every project in Canada, with very few exceptions, can be subject to EARP requirements. This is a great change from the past, when a small percentage of projects had EARP responsibilities. Now, wherever there is fish or fish habitat, wherever there are navigable waters, wherever there are federal monies, federal lands, federal interests, EARP must be applied and applied very rigorously.

The Rafferty/Alameda decision, for example, said that if you have an EARP application, and the impacts of the project are not insignificant and cannot be mitigated by known technology, then you must establish a formal environmental assessment panel. In the past, we have had the ability to apply appropriate scale to different projects; in other words, some projects go through the process quickly, and others have to go through formal reviews. That ability to design a process to meet the requirements has been somewhat curtailed by the courts' decisions. We are in a different ball-game now, and the game is wide open. The courts' decisions have basically thrown the rules out the window by saying that almost every project must (or could be) subject to EARP.

Another significant aspect of those court decisions is that the EARP guidelines order is a legally enforceable document, a document that can be interpreted by the courts as legislation. It was produced as a guideline; it was written as a guideline; it is now being interpreted as legislation. That is creating the major problem for us right now.

What are we going to do about it? Well, over the past few years we have been following our own advice of telling other people how to consult the public. In 1987, we initiated a public consultation program on possible reforms to the EARP process. At that time, the Minister of the Environment, Tom McMillan, issued a Green Paper on possible reforms to the EARP process. In the fall of 1987, we began a series of consultation meetings across the country with industry people, the CPA, public groups, etc., to talk about the Green Paper and possible reforms to the EARP process. In March 1988, that consultation process culminated with a national workshop in Ottawa.

In the Throne speech of April 1989, there was a government commitment to introduce a Canadian Environmental Assessment Act. In March 1990, the submission to Cabinet was made, and it is being discussed right now, which is the reason that Ray Robinson is not here. It is hoped that a draft act could be ready for introduction to the House as early as next month. We will have more word on that very shortly.

Because the Cabinet has not yet finished considering the draft act, it is not possible to be specific about its contents. However, it is possible to outline the issues and concerns about the present EARP process that were discussed at the national consultation workshop. This will give you some idea of the issues that are being considered in terms of reforms to the process and what could be in a new act. At that workshop, people said that the guidelines order was not good enough and wanted an Act of Parliament. In retrospect, some of the public groups may well feel that the guidelines order is much better than an act right now, because of its very broad application. Nevertheless, there was support at that time for the EARP to be put into an act. They also wanted a broad definition of the environment. Right now the EARP process applies only to projects with bio-physical impacts. They wanted the application to include social and socio-economic impacts. There was a feeling that the process should allow for consideration of questions, such as need for the project and alternatives to it.

A very controversial aspect of this whole package is the need to incorporate the principles of environmental assessment into government policy development. A number of alternatives are now under consideration. There was a feeling among most participants at the workshop that there was a need to maintain what we call the self-assessment aspect of the process. The decisions on projects that have to follow the environmental assessment requirements are made primarily by the decision-making departments and agencies. But there was also the feeling that there was a need for more checks and balances, which would ensure that there was some rigour and some consistency in the applications of the process. In the past, there has been a very inconsistent application of EARP requirements by different departments.

IAN SMYTH:

Now we are going to hear from two consultees and one consultor. We will start with Jim Livingstone, who is chairman of the Environmental Impact Review Board set up by the federal government and the Inuvialuit. Following Jim's presentation, we will hear from Earl Johnson, of the the Come-by-Chance Fishermen's Committee and then from Tom Thompson of BC Hydro.

Jim Livingstone is well known to almost everyone through his previous career with Gulf Canada. Jim was born in Sydney, Nova Scotia, and graduated from Dalhousie. He is an economist, and he worked with Gulf Canada from 1976 until 1988. He is currently the President of Fedmet Tubulars, which is a division of Federal Industries of Winnipeg. Having made the move from Inuvik, as Gulf's Manager of Northern Affairs, to the south, he is based in Calgary these days. Jim's days with the North are certainly not over. As I have already indicated, the Inuvialuit Game Council nominated Jim to serve as Chairman of their Environmental Impact Review Board, and with the consent of the federal government, he was appointed for a three year term in January 5, 1989.

Jim, we are looking forward to hearing you, because you do bring a great background of knowledge and experience of the public consultation process. We will hear your view of what northerners want from public consultation processes as they pertain to development activities in the Beaufort Sea and the Mackenzie Delta.

JIM LIVINGSTONE
Chairman, Environmental Impact Review Board
THE PUBLIC CONSULTATION PROCESS—A NORTHERN PERSPECTIVE

Good Morning Ladies and Gentlemen. It is indeed a pleasure to be here this morning and to participate in this very important and timely subject, the public consultation process.

When Barry Virtue asked me to speak on this subject, he said, "We believe you are well suited to comment on this topic because of your experience in the North with industry, and more recently as Chairman of the Environmental Impact Review Board."

I had to give some thought on just how to approach this subject. My last five years with Gulf were spent trying to avoid public hearings in the North. Some people actually thought I did a very good job of that, considering Gulf was able to get approval to drill the first well on Inuvialuit land without a public hearing in 1984. Then, in 1986, Gulf was able to get a supertanker of crude oil out of the Amauligak field without a public review. Then again, in 1987, Gulf got an extended flow test approved, which has involved 18 to 24 loaded supertankers a year for a period of five years. Again, this was approved without a public review.

So I wasn't sure if Barry wanted me to give the CPA member companies here some advice on how to avoid public hearings, based on my career with Gulf, or how to prepare for a public hearing, based on my current position as Chairman of the Environmental Impact Review Board.

What I decided to do this morning was describe the Board and its role; how northerners within the Inuvialuit Settlement Region view the public consultation process; and conclude by giving you my opinion on how northerners and the oil and gas companies operating in the Inuvialuit Settlement Region can make the public consultation process more meaningful, effective and efficient.

The Environmental Impact Review Board or EIRB was established under the terms of the Inuvialuit Final Agreement (IFA) between Canada and the Committee for Original Peoples Entitlement. In June 1984, the IFA became law under the Western Arctic (Inuvialuit) Claims Settlement Act. This Act further provided in Section 3(2) that the beneficiaries under the Agreement "...shall have the rights, privileges and benefits set out in the Agreement," and in Section 4 that the provisions of the Act and of the Agreement will prevail over any other law applying to the Territory in the event of inconsistency or conflict.

Being a land claims settlement within the meaning of Section 35 of the Constitution Act, 1982, the Agreement is thereby affirmed as an existing aboriginal right. In consequence of these statutory provisions, the terms of the Agreement are given a preferred status over all other federal and territorial laws within the defined Inuvialuit Settlement Region in the Western Arctic.

Put simply, the IFA is a very powerful piece of legislation.

The Board is given its mandate under the following sections of the IFA:

Section 8 deals with the setting of environmental standards in the Husky Lakes/Cape Bathurst areas.

Section 11 deals with the operations of the EIRB and the control of on-shore developments.

Section 12 deals specifically with development activities on the Yukon North Slope.

Section 13 deals with the prevention of damage to wildlife and its habitat by offshore developments and compensation to the Inuvialuit if damage occurs.

Without trying to bore you with a lot of details, the Board functions in the following manner:

If the Environmental Impact Screening Committee decide that a proposed development could have "significant" negative environmental impact, the application may be referred to the Board. The EISC can also choose to refer a development proposal to a governmental environmental impact review process, rather than to the Board, if they feel that review process adequately encompasses or will encompass the assessment and review function.

The Board within 30 days of receiving a referral from the EISC will meet and determine what additional information it will require from the proponent, including what the Board expects to be submitted in an Environmental Impact Statement.

Once the Board has received all the requested information, a Review Panel consisting of four of the six permanent members, plus the chairman, is struck, and they determine the type of public review to be held. A public meeting or a full public hearing may be selected by the Panel as the public review process.

Once the public review has been conducted, the Board will expeditiously render a final decision.

The Board will recommend whether or not the development should proceed. If the Board decides that the development may proceed, it shall make recommendations as to terms and conditions that should apply to the development, including mitigative and remedial measures. The Board must also estimate the potential liability of the developer, determined on a worst-case scenario, taking into consideration the balance between economic factors, including the ability of the developer to pay, and environmental factors.

The Review Board may also recommend that the development should be subject to further assessment and review.

If the competent government authorities are unwilling or unable to accept the recommendations of the Board or wish to modify any of them, reasons must be provided in writing, within 30 days. The reasons for not accepting the recommendations will be transmitted to all interested parties and will be made public.

No licence or approval can be issued that would have the effect of permitting any proposed development to proceed unless the provisions of the Environmental Impact Screening and Review Process have been complied with.

I have used the term "development" a lot, so let me define the term. Under the IFA, development means any commercial or industrial undertaking or venture, including support and transportation facilities relating to the extraction of non-renewable resources from the Beaufort Sea, other than commercial wildlife harvesting.

Ladies and gentlemen, as I said earlier, the IFA is a very comprehensive agreement and piece of legislation. I would like to make clear that the Environmental Impact Screening and Review Process is not an Inuvialuit Process. It is a joint federal government-Inuvialuit process, with each side having equal representation, and the chairman being appointed by Canada with the consent of the Inuvialuit.

The Board is made up of three members appointed by the Inuvialuit and three by Canada, plus the chairman. Other members may be added from other native organizations, such as the Dene/Metis and council of Yukon Indians, if the development proposal within the ISR could affect them. Additional members representing Canada would also be added to keep the representation equal.

The Board's operating budget is less than $250 000 per year, and this past fiscal year the Board had an operating budget surplus of over $100 000.

All seven board members have full-time jobs, besides their Board appointments, and, with the exception of the chairman, they all live in the North. None of us make our living conducting public reviews, so we waste very little time in conducting these public reviews and rendering the final decision.

The only staff the Board has is a half-time position of secretary. The taxpayers of Canada get excellent value for the money they contribute to fund this process, as the Board really meets only when it is required to do so because of a proposed development.

Members of the Board representing Canada are appointed for three years by Canada, and the Inuvialuit members are appointed by the Inuvialuit Game Council and are reviewed annually. My term as chairman expires April 1, 1992, which leaves me with 698 days left, as of today, to serve on my three year sentence as chairman.

Let me give you my views on the public consultation process in the North from my experience on both sides of the fence.

My first point is that most northerners do not trust government processes, and that is why native land claim settlements now contain a joint native and government review process.

They fear that a process like the NEB and FEARO would make decisions based on the national interest and not on the regional interest of northerners.

Many northerners find that processes like the NEB and FEARO are staffed with people they do not know, and panel members are often not familiar with the North and northerners' very close and special relationship to their land. Often these processes get tied up in too much red tape and legal jargon. and the hearings end up discouraging rather than encouraging public participation.

Consultants and lawyers too often end up being the winners under these complicated, and long, drawn-out public hearings.

I would like to spend a few minutes to describe how the Board conducted the public review of the Esso Chevron et al. Isserk I-15 Drilling Program. Basically, once Esso had submitted the required information, the Board selected the Panel, and gave 30 days public notice. On October 24th, in Tuktoyaktuk, the public review started, using the public meeting format.

Over the next three days, the Board heard close to six hundred pages of evidence, and many local residents came forward to comment and ask questions both of Esso and the various government agencies. I felt the high level of public participation was achieved mainly because the Panel selected the four key issues concerning this particular drilling program. On the second and third days, these four issues were carefully tested by a process of direct questioning of the Esso representatives and consultants, by the Review Panel and staff, by the Inuvialuit Game Council, the Inuvialuit Regional Corporation and by the other participants, including the government representatives and the general public. Everyone co-operated in a very professional manner, and the media got so bored they left at noon on the first day of the hearing.

Once the public portion concluded on October 27th, the Panel rendered its decision expeditiously, as required by the IFA, and had the report in the hands of the appropriate governmental authorities by November lst. The whole process, from the time EISC referred the program to the Board until the Board rendered its decision, took 63 days. This was possible because of the excellent co-operation and information the Board received from Esso and the participation of various government agencies.

The presentation that impressed me the most was the intervention by the Tuktoyaktuk Hunters & Trapper Committee. Their intervention was hand-written, and was read by their president and a long time personal friend, Frank Pokiak. I am going to quote from the last section on compensation because I feel this is the way many Northerners view the public consultation process.

"Any compensation package should have the following features:

- It should be simple and put in place quickly.
- It should be easily accessible to the people. We don't want all the money to go to lawyers and consultants.
- It should contain different ways to replace what is lost.
- It should be in place for the whole life of the project, from the time they spud until the well is pumped dry."

My own personal opinion on the public consultation process, based on my experience in the North, is that the native people will demand that the environmental review process contained in their land claim settlements will be the primary environmental review process used within their land claims settlement region. Other environmental review processes such as the FEARO and the NEB will be secondary, and come after their process has been completed. They will be used to deal with large mega-projects such as the Mackenzie Valley Pipeline. Nothing in the IFA prevents the government from conducting its own environmental assessment and review.

Let me offer some suggestions on how the public consultation process can be made more meaningful, effective and efficient. First of all, government agencies must be able to respond to the information supplied by a developer within sixty days. I'm talking here about routine development proposals such as the drilling of a well. The larger, more complicated projects will take longer to review and respond to.

Everyone including the Board staff, the developer and government agencies must share all the information and avoid surprising each other at the public hearing. Both sides may disagree on the information supplied or the assumptions and facts contained in it, but they must have had a chance to review it, prior to the start of the public review.

Oil companies should do consultation in the communities impacted by their proposed activities prior to submitting their proposal to the environmental screening and review process. These community consultation meetings should inform the local people and identify issues of concern. An informed public, with good, reliable information is the best way to insure an effective and efficient public review.

Be honest and put all the facts on the table including the worst-case scenario. Hopefully, you can provide a contingency plan to deal with the worst case. Northerners realize the chances of a major incident like an oil well blow-out may be very small; however, the effects of such an incident are enormous.

The most important part of the public consultation process are the people who do your consultation for you. To win the respect and trust of northerners takes a very special person and a considerable amount of time and effort. When you find the right person, make sure everyone, from the president down to the roughneck, supports what that person tells the public. Northerners like to see the same old face coming to tell them the same old story. Once you lose the trust and respect of the people in the North, it is very difficult to get it back.

I would like to conclude this morning by commending the oil companies operating in the Inuvialuit Settlement Region, namely Esso, Gulf, Amoco, Chevron and Shell, for the excellent job they do on public consultation.

However, please be advised that the events of March 24, 1989 on Bligh Reef have changed the way northerners view the oil industry. The worst case has occurred, caused by complacency and neglect. Success breeds

complacency; complacency breeds neglect; neglect increases the risk—until the right combination of errors finally leads to an accident of this disastrous proportion. Now oil companies will have to prove that they can deal with the worst-case scenario to the satisfaction of the public and not just the governmental regulatory agencies.

Many Northerners agree with the report of the Alaska Oil Spill Commission on the wreck of the Exxon Valdez, and they are very skeptical of government's ability to regulate the oil industry in Canada. One statement in that report has caught a lot of attention is:

"For reasons that include not just underfunding, but also confusion of mission and an unduly friendly relationship with industry, the Coast Guard has failed the American people in providing oversight of the country's oil transportation system."

Governmental regulatory agencies are losing the confidence of northerners that the oil industry is being properly regulated. The unfortunate victims in this current situation are the oil companies, who will be subjected to more public reviews until the confidence level is restored.

My advice is that these various governmental agencies should do more public consultation, so the public first understands who they are, what they do, how they regulate and what they can do to minimize the effects when the worst case happens. Industry shouldn't be expected to do it all.

IAN SMYTH:

Earl Johnson is a fisherman. He is also a member of the Environmental Studies Research Fund Management Board. He is the Chairman of the Come-by-Chance Fishermen's Committee, which represents some three hundred fishermen, and he is the Chairman of the Inshore Fishermen's Improvement Committee, which represents some two thousand fishermen. He is a council member of the Fish Food Allied Workers, which represents eight hundred fishermen. There may be some double counting in there, but that doesn't matter. That's a very impressive set of numbers. He is a member of the Nautical Institute, which is based in the United Kingdom, and he is a member of a variety of Coast Guard committees. He is also the man who said he is going to get through his presentation in ten minutes. But Earl, coming from Newfoundland, I don't know if you are going to make that deadline. In any event, let's welcome Earl Johnson.

EARL JOHNSON
Come-by-Chance Area Fishermen's Committee

EAST COAST PERSPECTIVE

Good morning. I am very honoured to be able to speak to such a group, and I think I can say without hesitation that this is the first time that an ordinary fisherman has ever had the opportunity to speak here, and certainly the first one from Newfoundland and Labrador.

When our committee started up working with Mobil Oil, many people, as well as the fishermen and the general workers and everybody else, said, "Why waste our time? They want to do whatever they want to do anyhow, and they won't listen to any of us." Well, from our communication since September of that year, I think and hope that a lot of those people have been proven wrong.

Now many of the previous speakers supplied a brief, but I haven't. For the past two months in the Newfoundland fishery, things have been pretty hectic, as you may know. In the month of March alone, I attended between 20-25 meetings, and about 18 of those were night-time meetings. The rest of March was spent getting our fishing gear ready for the fishing season, and in April, we had about 15 meetings, three on one Sunday—so much for that.

But as chairman of the Come-by-Chance Fishermen's Committee, I assume all of you know where Newfoundland is; but judging by radio reports, it sounds like a lot of people in this part of Canada don't know, so I'll get to the next slide. This is the eastern part of Newfoundland with St. John's—apparently most of you have been there. Here are the two main areas for Mobil Oil right now. This is a larger scale of the refinery, Trinity Bay and Mosquito Cove. The Come-by-Chance Fishermen's Committee represents fishermen in the part where Hibernia construction was slated to take place. We represent fishermen from over nine communities.

All this changed last fall, when Mobil Oil tried to put their construction over in Trinity Bay, Great Mosquito Cove. It took a lot of pressure off our shoulders and placed it on the fishermen's shoulders in Trinity Bay. Hopefully, they can work out something.

In September 1985, our meeting started with Mobil Oil and Come-by-Chance, and from day one they seemed pretty co-operative. Prior to those meetings the rumours were running wild about what would happen to the fishing industry, and about where they were going to build—nobody seemed to know anything. With encouragement from the Development Association, they met with the Mobil people, and there are some of them here today. They told us what their plans were, and we told them what our concerns were. It was a pretty active meeting, and probably went for four hours. At this September meeting, I was elected chairman of our committee and I was invited by Mobil to attend a major workshop in St. John's.

My definition of chairman is mouthpiece. It was at this workshop between the oil industry and the government representatives in St. John's that I became convinced that we could work together and solve our problems and differences. I spent about an hour on the hot seat explaining our problems and answering questions from probably 40-45 there. There was one member from a large offshore fishing company, and he was sort of getting pretty fidgety. He felt the morning was a waste of time, and probably for him it was. Mr. Cam Oakley, who was the Regional Director for CP at that time, he turned around and said that the oil industry was interested in what he had to say, and he didn't consider it was a waste of time.

From that time onward, I felt an awful lot better about working with him. So later on at the public hearings, which have been mentioned in the last few days, with the Hibernia Environmental Assessment Panel, we expressed our concerns. They were addressed, and many of our concerns were put into the report—probably some of you have already read the report. Our objectives were that we would not lose our livelihood because of the construction.

This construction was to take place directly on a lot of our fishing grounds, which would mean a loss of income for us and loss of access, and we didn't want that to happen. If we were going to get screwed, we wanted to get screwed and enjoy it. So in order for that to happen, there had to be a lot of concessions and compromise on both sides, and by the fishermen as well as Mobil Oil. I say Mobil Oil, I mean Mobil Oil under a group of companies of a consortium. Because of the slowness of the project, we had a fair amount of time to get the homework completed.

Both the fishermen and Mobil Oil needed one major thing identified, and this was about where all the fishermen in the bottom of the bay fished, to what extent and what times of the year in their direct impact area and surrounding areas, in case they had some major pollution. To do this, Mobil Oil financed a major project for us. A study was completed prior to the changing of the project to Trinity Bay. This project took about four months, with a girl running around every single fishing master in the bottom of the bay and getting down exactly his fishing gear, where he fished, and what time of the year and so on. A pretty comprehensive study.

Over the years we have built up an excellent working relationship with the oil companies, so that when the study was completed there last year, it was turned over to Mobil Oil without our committee having it, and it's still in their possession. We trust them; hopefully the trust won't be broken. We will soon be deciding whether to destroy the study or secure it for the future, mutually agreed by both parties. As it turned out, the information is irrelevant because they went to Trinity Bay, but it goes to prove that we can work together—the public, the fishing industry, and the oil companies. Some of the fishermen that took this survey went so far as to find their T4 slips for the past three or four years to prove to the girl doing the survey that they weren't bull-shitting. And it is through a joint effort such as this that can lead to amiable solutions to most any problem.

Now this being from Newfoundland, but in Nova Scotia, there seems to be some co-operation in certain areas. For the offshore fishery in eastern Newfoundland, the compensation control package for the offshore fishery was worked out fairly quickly. Now in Nova Scotia the result was different. Now, I personally feel that had there been more consultation earlier in the game, from day one, the results could have quite easily been different—I could be wrong, I've been wrong once before. The friendlier co-operation, the more information that's passed back and forth, the quicker and easier solution to most problems can be found. When I refer to talking to the media, I mean instead of the fishermen's group going to the media and sounding off, and then oil companies going to the media and sounding off against that. Negotiations through the media don't work, but negotiations with both parties together, that's the kind that do work. For any project, whether it be the offshore oil industry, inland oil exploration or any construction work—any big project—for a smooth relation, the company moving into the area has to work in conjunction with the local people.

The others who work with the local people, they should not have to finance their legitimate work in trying to protect their livelihood. There should be so much money placed by the company in a fund for that area to work on. It might cost a few thousand dollars in the first place, but it will pay off in dividends in the long run. If some of the fears are unfounded in the company's viewpoint, the company should take x number of people from this local area and take them to places in other parts of the world, wherever it is, where the same type of work is taking place and show them exactly what's going ahead there.

From our experience, we're very leery about large companies coming in, and government as it is, saying, "Don't worry be happy. We will look after you." When Mobil Oil planned to come in, the people said to me, "No pollution. No disruption." And up until last year, our government was telling us if we say anything to protect ourselves, we are only shit-disturbers. It worked okay out in Norway, so why can't it work out in Newfoundland? Well, in Norway where they build twelve or thirty in those groups, there is no local fishery so they should be able to get along pretty good. Since this location has changed over, it would settle a lot of fears among the Trinity Bay fishermen, if the Mobil Oil group would send a delegation of fishermen from our area. Then we cost Mobil Oil a few thousand dollars, but it would be an excellent public relations for them to do this job. We were requesting it from day one, but we weren't successful, even though they helped me out last fall to visit there a while.

For different groups to work together, it is very important for each group to know so much as possible about the other group. Since our discussion started in 1985, we got the one person, in particular Leslie Grattan. They spent many days in small fishing boats in the bay, some fishing, others doing research work, and they are learning about our way of life and the problems they would encounter in our area. They see exactly where our livelihood is coming from. And myself, I became involved in other groups, one, in particular, the Environmental Studies Research, that have helped me and, in turn, helped other fisherman understand the workings and limitations of the oil companies.

There are two sides to every story, and judging from the October 1989 conference in Bergen, Norway, Canada is far ahead of other countries in co-operation between the fishing industry and the oil industry.

Having spent the past four years now dealing with the oil industry, we don't know yet if the oil industry was sincere in their dealings with us. And from us from the Bay, we don't know. We don't care now because it's out of our area. Anywhere that the oil companies are sincere in their dealings with the public, and it's the smoothest way to go, we try to work with them, and they try to work with us. We feel it can be pretty good on both sides.

I could continue a while longer, but I feel I've said enough to give you a good idea about our work and our co-operation with the companies in eastern Canada. So, once again, I say thank you for having me here, and to the organizing committee for inviting me here to speak with you today, and for having the patience to listen to me. So if there are any questions, I will try to answer them the best way I can in the next few minutes.

Thank you.

IAN SMYTH:

Well, we will now move to the other coast to hear Tom Thompson, who is Manager of BC Hydro's Public and Governmental Affairs. Tom is a westerner, and he attended Queen's University in Kingston and York in Toronto. He is an economist by profession, and has worked as a consultant in socio-economics and as a director of a BC-based environmental group prior to joining BC Hydro. For fifteen years, he has worked in various positions with BC Hydro in operations, corporate planning, corporate affairs and currently, as I said, as Manager of BC Hydro's Public Affairs and Governmental Affairs. Another consultor. Thom?

TOM THOMPSON
Manager
Public Affairs & Governmental Affairs, BC Hydro

AN INDUSTRY VIEWPOINT

Thank you very much. I, like everyone else, tried to figure out why I'm here—particularly why I'm here as the last speaker, following somebody from Newfoundland who was probably going to have everyone laughing. I have come to the conclusion that I am here to cheer you up. You have got your problems trying to get major projects through; when you have heard about our potential, you'll feel better, I hope. I still really want to know why they moved to a place called Great Mosquito Cove. I think there is more to this than he is telling us. I'm glad you're on that coast.

I'll give you a bit of background about BC Hydro. The organization is about 30 years old. We were formed primarily with a vision or, if you like, a mission, which was created by the British Columbia government, to build two major projects in this province, one on the river right outside here, the Columbia, the other on the Peace in the northern part of the province. Two major projects, and some of you may remember the controversy at the time. The major political decision, the policy decision of government, had been taken, and we were simply the ones carrying out that decision.

In those days there were very few public hearings. As you know, in the 1960s, environment was really a dream in some people's eyes. Society, one way or another, accepted that consensus was the thing to do, and the projects went ahead, and we are still living off them. They were very large projects, as you can imagine. In fact, just as a historical aside, one of the ways of constructing that Columbia project would have put this place under about 50 feet of water. So that's the way history goes for you. I don't know how much consultation there was in this area. I don't think very much.

In the 1970s, the period when environment got into full swing in the first sort of manifestation of public involvement, we'd run out of our mandate. The two rivers had been developed, and we were running into a genuine debate in society about growth, about needs, about future power needs. Every utility—we weren't unique in this—in North America faced this. I don't think the oil and gas industry didn't face it the same way as we did. For reasons that are associated with the nature of power and perhaps the projects as well, consensus had broken down. People no longer agreed that growth was the best way to go. The large projects were the way to stimulate the economy and great surpluses of electricity were necessarily the way to create economic development. We started those debates really with the Revelstoke project in the mid-1970s. Again that's not too far from here, but it was the largest project after the two major ones on the Peace and the Columbia. In fact, as events unfolded in the 1980s, it turned out to be the last major project that we built, because as we went into the eighties, the province went into recession.

We really didn't need any power for about the next eight or nine years, and again society wasn't thinking about environmental questions as much as economic questions. At the beginning of the decade, we were out talking to the public, dealing with as many as probably 40 projects, counting transmission and so on, and suddenly recession came. I use the analogy of a castle, and we all retreated back into the castle, and the drawbridge went up and silence reigned for the next eight or nine years.

Now we are back out the door again, because the load has caught up with the demand and we have to start considering new projects. At the same time, we are regulated—boy, are we regulated. At the federal level, we haven't had to go through full hearings or anything like that yet. The decisions on the two dams that we talked about this morning have implications for us in the future, certainly. Until now we have been mainly regulated at a provincial level, and we have the distinction of being a government agency, a crown corporation. We are directly influenced by government policy and our Minister is on the

Board. At the same time, we are regulated by the BC Utilities Commission, which reports to the same Minister. So, in one sense, you have got almost a setup. How do you deal with government policy when you also have to deal with regulators? Do regulators follow the same government policy as you do? It's your guess, but it creates another level.

Our projects are regulated, and so are our rates. I should back up a step, the last major project referred to the BC Utilities Commission was in 1981, a project on the Peace. If you have been hearing about 60 day hearings and 30 day hearings, forget it. We were there for 11 1/2 months, and that's solid months of hearings. That's counting days, not the time, which was actually more than a year. The deliberations took about six months after that. A report came down, the project wasn't built, and that was the last major hearing we went through. I don't think anyone in Hydro, and I doubt anyone subject to regulation, wants to go through that again. Public hearings in my mind, are almost like going to court; they are the last resort.

This brings me back to public consultation, because one of the reasons for doing it is to get agreements, to get through some of the hurdles so you don't find yourself ending up in a venue where, in fact, a decision is wasted on you. You may not want the regulators to make it; the government may not want to make it; and the people might not like what they get in the end, anyway. It's just not the way to go, as far as I'm concerned.

As far as consultation goes, I'm discovering that corporations are changing a lot. The old hierarchical system in the corporation is breaking down. Several years ago, for example, engineering was totally in charge of a project and anybody else who tried to say something about it, that wasn't a viewpoint, was looked into. In corporations right now, we are breaking into what we call power work teams; that's the latest jargon. It means internally incorporations are forced to work across disciplines. It's almost a microcosm of society, in a sense, and it should be, because the arguments have to go on internally as well as outside.

People are having a hard time adjusting to this. You can't just go to your boss and say, "Is this what I do?" and think that's your marching orders. You have to deal with a whole lot of other people internally; in other words, you have to consult. In fact, you have a responsibility to consult in that kind of setup. If you don't, if you take a decision on your own or overrule somebody else in the corporation and don't consult and don't listen and don't appeal it to the proper places, then you probably should be chastised. With the government and corporations alike, people are beginning to realize that if you are consulting internally, if you've got inter-disciplinary teams working on projects, small ones, large ones, if you are involving your own people, then it's a fairly simple matter to just forget about that border at the edge of that corporation—it doesn't exist. It doesn't exist in a very real way because you have to go outside to talk to people to get some of the things you need, to understand things, but if you are already doing that internally, there is not a whole lot of difference in going outside.

Just to get wide public consultation, there are lots of events you can point at, but the ones that are horrifying to me are the ones that we are seeing in Eastern Europe right now. It's a classic example of a case where the public has not had a say in matters (where, in fact, to have a say in matters put you in jail). The pollution they've got, the environmental disasters they've got, among other problems, are obvious, and I think that's what happens when you don't have the checks and balances, plus implicit consultation, consultation through all parts of society.

As far as secrets go, whether you can keep things quiet that go the way of the fax, the xerox, you name it, that's democratization. There are no secrets, and it's just impossible, even if you want them. I think that was still a debate in the 1970s, and now it just doesn't exist. People find out things and they should know them—there is no reason why they shouldn't. How they find out and what they find out and how you try to steer that process so that people aren't wasting their time are the critical questions.

How do you decide when to consult, whether it's internally or externally, with government or with anyone outside? We really had some problems with this one. Just when do you, and when don't you? Literally, if you start consulting all the time, you won't do anything else; you will just talk and nothing will happen. There is no question about that. We have come up with a bit of a slogan: "Better decisions through informed and involved stakeholders". No one likes the word "stakeholders", but we couldn't find another one, so I apologize for that. We are saying that your basic reason for doing what you are doing is to get a better decision. If you are trying to compare something or trying to do something or take some action, if it involves whether you use widget one or widget two, it's a purely technical decision, perhaps economic at most. There is nothing in that decision that any amount of hearing procedures, any amount of public discussion or government involvement or anything else would help you make a better decision to do that. Forget it. Don't bother.

There is another kind of decision that involves other people, their values. Obviously it's a decision you have to consult about. A decision like that can frustrate both sides, both the proponent, and the other side. If you just throw the whole thing out again, there being no secrets, saying we are here to consult, these poor people end up getting involved in the logistics of a hydro development or transmission lines 500 kv or 230 kv. It's not what they are interested in; it's not what they want to talk about; there are other things. Other people said that differently earlier, that the interest on each side is different. Again, try to sort out what decisions are the ones that you think are negotiable, the ones you think the other side is interested in talking about. That's helped us, at least so far, and I hope it does in the future.

Back to the issue of consensus again. We're right back in the soup on that one in British Columbia. The debate rages about whether growth is the right way to go, and what kind of growth we want. The consensus is no more there today than it was twenty years ago. If anything, it's going to break up even further. The public that benefits from these kinds of developments is not the public that gets impacted; they are not the fishermen of Come-by-Chance;

they are not the native Indian band of the Peace River. The people who benefit from the developments are here in British Columbia, the people in the lower mainland generally—that's the growth area—but the impacts are somewhere else. The interests are different between the two, and yet you will get the people in those areas where the benefits are getting very involved. They don't even know where the development is or don't care, but it has become a cause celebre. They get involved in it because they think it offends some idea of what they feel is proper, but at the same time they are the ones demanding the product, and I think all of us get frustrated by that. I hate to allude to this, but the timing was wrong when the chairman of Exxon, right after the tanker went aground, and in frustration as much as anything else, said, "Who's the one using this oil?" I sympathize to a some extent. It was the wrong time to say it, but that's part of it.

In your industry, as time goes by, as people question the use of fossil fuels—they are already are—you're going to have to link somehow the customer or the consumer of the product to the one who doesn't want the environment consumed. The way I put that to people is,"Look, I want you to understand what the environmental implications of this course of action are. Whether we build a dam or whether you save power by turning out the lights, it's only if you understand that and you make the proper choices." The choice whether to build a dam or whether to build a transmission line or whatever isn't made at the hearing. It isn't made when we make a presentation to government. It's made when decisions are made by people to turn on the lights, to turn off the lights. That's when the decisions are made. In the energy industry with the environmental thing happening to us and around us, we are part of it, and that's one of the linkages we have to make. A consultation, talking to the public and informing is one of the ways to bring those two together.

A few more points. You talk about pipeline routes, and I envy you because when we're out looking at transmission lines people say, "Why don't you put it underground?" So if you want a pipeline built sometime and need help from us, maybe we could clear the way for you little bit. But our process has come down to looking at very broad corridors. Compared with even ten years ago, when we used to have a preferred route, and we would go out and maybe have some other routes written in pencil, but we would go out with the one in ink. We were sort of walking out with a target, and we'd get everyone begging to shoot us and seeing how bad it was, and then we might go and look at another one. I'm exaggerating. We sometimes had three preferred routes, but it didn't matter. We got shot three times.

We are trying to say all right, as a public utility there are choices to be made. Again, I come back to that word. There may be several possible routes for this transmission; in fact, there may be other alternatives to that transmission line. All of those things are open to public debate as far as we are concerned. The only things that aren't open to public debate are the technical considerations. If you can't build a transmission line straight up a mountain, okay, that's out; everything else is in. The choices aren't ours, in a very real sense—the technical ones, perhaps, but not even the economic ones. After all, that's just the price of the electricity. and if you choose a society that wants the

more expensive route and you think that's the way it should go, then the price of electricity goes up. Those two things aren't something we are going to go to battle over. The public has to decide.

We are finding, ironically, when we go out with a multitude of choices, the public is coming back to us to say," Wait a minute. What have you guys got up your sleeve? You really have a route you want, don't you? Which one is it?" And they all want to guess what it is. But we are genuine in throwing out that decision. Our chairman calls it "rendering unto Caesar". It's a decision of the government; it's a decision of the people.

The final thing I'll just mention is mitigation of compensation. We are having great internal debates again about that right here in this valley. Around the Colombia system are various mitigation compensation agreements made over the last 20 years. I say various, anywhere from 30-40, maybe. It's like a road map. You can read them and see what people were thinking at the time, how environmentally conscious they were, because the first ones were fairly small, and they get bigger as time goes by. For some we gave them money; government administered some; we still have some; some went into public groups; it's a mish-mash.

The other thing it doesn't address is the long term. These projects could last 700 years, not 60 or 70. They could be here for a long, long time and we're starting to think in terms of on-going funds that will be put into the public regime somehow, that would cover all of the compensation mitigation, say, for a river system. It would be something like a perpetual fund, out of which interest is gathered and public and government agencies and whoever else has an interest in it over a long period of time would decide how that money is spent, not us. Nor would we decide the amount of money that we put in the fund. That would be decided by the government or others. With that concept, we are starting to broaden out where we are going with public consultation. That squarely puts the decision out saying, "Okay, here's what needs to be done with these river systems in the future. It's your decision and here are the dollars to do it." We're not there yet, but I do see that as a way to go in the future.

We are well past the days when you went through a hearing, you were told what to do and given the money to do it and then walked away. It just doesn't work. Three years later you're back because it didn't work. I see the on-going mitigation on compensation like that. I see the ongoing public contact as a positive note because it maintains that contact in that community that you're going to need. You're talking to people there, so you're not coming out just when you happen to need a large project. Thank you very much for the opportunity.

DISCUSSION

IAN SMYTH:

Well, ladies and gentlemen, there is time for questions, and I am sure that the points of view expressed by the folks here are bound to stimulate something. So, who's first?

You can't all want to check out that early.

GERRY GRAHAM:

I just wanted to ask Earl Johnson what he thinks about the refinery of Come-by Chance and how does he feel about tankers passing generally?

EARL JOHNSON:

For the past year and a half we have had one tanker run the shore with a 130 foot gash in her bough; another, with 200 000 barrels of oil aboard, first cleared the dock and just barely missed the rocks by running the shore. We have had another one with five or six cracks in her hull that cost $500 000 to get repaired, and we have had other ones there with radar not working, and they declare they were working, so we are very concerned about it. We are working with the Coast Guard trying to keep this from happening in the future. For the Grand Banks part, I don't fish on the Grand Banks, but a lot of my friends do. We have got worries about it, but we are hoping with technology to be able to keep the spills to a minimum.

IAN SMYTH:

What I'd like to ask is the other half of that question and what's your experience with the east coast Co-operative Oil Spill Research Group?

EARL JOHNSON:

Not a lot. I have known most of the people on those Boards, and some of them from the east coast, but I haven't seen their equipment. From what I hear, it's very good standard of equipment. [inaudible] The Coast Guard can, and hopefully they handle the spill, which I doubt.

IAN SMYTH:

Are there any more questions? Well, I will ask you then to join me in thanking this panel. I will have a few wind-up remarks to say, but I do very much appreciate the views that we have heard from this group this morning. I thank you very much.

WRAP-UP

Now, in order to get you out of here on time, I will throw away the 45 minutes of concluding remarks that Leo Bouckhout wrote for me. In point of fact, I have a few notes to remind you of one or two things that you heard during this conference.

Doug Baldwin opened by talking about the seven requisites for frontier development: geology, policy, production technology, environmental technology, economics, a trained workforce and last, but not least, capital. Jake Epp, in his introductory address, dealt with a different dimension. He talked about the trust and the co-operation that are necessary. He said that the petroleum industry has a good story to tell, but he admonished us, as he has done on other occasions and in other places, for failing to tell it well enough or often enough. He once again urged the industry to be better in its communications with the public. I wish I had been here for that one, because I would have liked to have asked him how we do that.

The energy issue per se has dropped off the public agenda to the point where it isn't even the first mention by one percent of Canadians, when asked what they think are the major issues facing the country. I am troubled sometimes by our failure, our inability, to persuade the media to deal with our industry objectively on environmental issues. We hear a great deal about accidents, fear and risk. Too often the message is couched in terms of: "What happens when the plane crashes?" rather than "What are the chances that the plane will crash?" Nevertheless, it's the plane crashes that make news, not a successful flight.

I am troubled by the fact that the petroleum industry is recognized by government as a leader—the leader—among the resource industries in terms of environmental management, is frequently perceived to be run-of-the-mill by people on the outside. Even in Calgary where the energy journalism is as good as it gets in this country, I'm interested to see, as recently as last Saturday, that the oil industry—the oil industry for God's sake—is jumping on the environmental band wagon. God, in our resource sector we have been driving that bandwagon for a long time, and other people have been hopping on it. It troubles me that we don't get good recognition for our efforts. So when Jake Epp encourages us to improve our communication, I guess the only choice we have is paid advertising, if we can't get balanced coverage from the media.

In the sessions on frontier potential and economics supply and demand, we heard that threshold reserves for production have already been proved; that access to large export markets must be available in order to provide the return necessary to proceed with development; and ultimately, economics will be the factor that dictates the scale and the pace of development. In that context we were told that the industry must think and act globally.

In session four, on the regulatory environment, we discussed the evolution of regional regulatory regimes under the federal legislative umbrella and the desirability of co-operation with local regulators. But, as we have heard

again this morning, the proliferation of regulators has the potential to make everyone's life more interesting, if not complex. The theme of co-operation carried through the discussions on oilspills prevention and response, with responsibility and accountability being dominant themes there. We were reminded that our industry operates by the permission of the public, a theme to which I am going to return as I close. Events such as the Alaska oilspill drain public confidence, notwithstanding the fact that it happened beyond our borders by a company in a foreign country and operating under a regime which is not anything like ours. Nevertheless, the Canadian public makes the identification with our industry and the Valdez incident. Don Gilman, the mayor of the borough of Kenai Peninsula, Alaska, challenged the industry to do its homework before it's too late, and his charge was prevention, prevention and more prevention.

In sessions six and seven, we learned of some of the tools available and being developed to confront the physical risks inherent in frontier production projects. We also learned from Renger Bierema that innovative thinking can do a whole lot to reshape projects both technically and economically, and we were reminded that Canadian technology is world-class. Several speakers talked about how that technology is being applied in the North and offshore projects.

Speakers and attendees have come to this conference from coast to coast, and three of our panelists came from outside Canada. We are grateful to them, but also to all of you who have come from many places. Before I close, I want to say a few words about what we have just heard this morning. There are three lessons in the context of public consultation, but which are demonstrably a challenge to operate effectively within the petroleum industry. First, I think the public's right to be involved in decisions that may impact, or that they feel may impact, on the quality of their lives is now accepted. Second, you have to earn public trust; they don't give it to you. It's easy to lose, and in order to earn public trust you have got to demonstrate that good environmental management is operative and visible and accountable all the way from the boardroom to the shop floor. If you lose public trust, it is awfully hard to get it back. To underline the point that was made earlier by another speaker, you operate by virtue of the public mandate, and if the public trust isn't there, you are either going to be constrained or out of business completely.

I thank you all for coming from so many parts of Canada and abroad to this workshop. It's the best attended workshop in the last ten years. I think it demonstrates the varied sources of interest, of influence, of regulation and above all of concern, which guide and direct our industry. I hope you have found it as useful as I have. I wish I could have been here for the whole thing, but I have had an opportunity to renew some old acquaintances and see some good friends, as many of us only see each other from one year to the next at this conference. So on behalf of all those old friends, all the attendees and your panelists, thank you very much for coming. See you next time.

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